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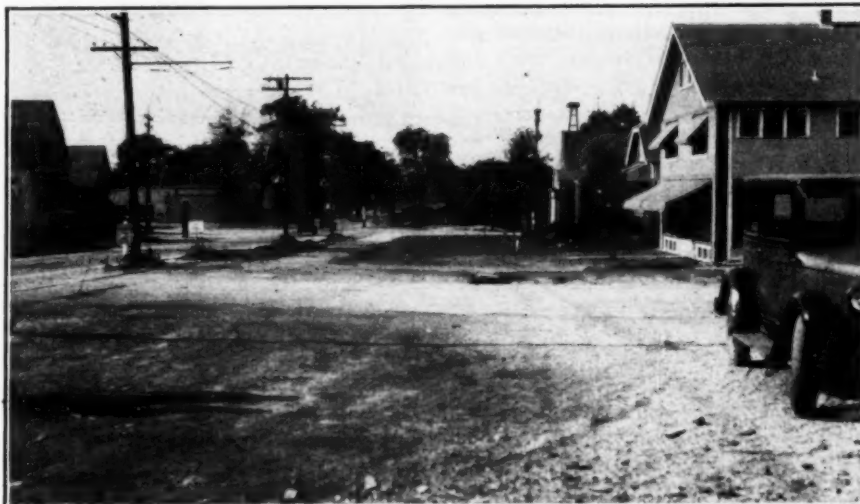
Its Importance to Modern Metropolitan Areas Described Together With an Account of How Milwaukee County Is Guiding Regional Growth

By E. A. HOWARD

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REGIONAL planning is simply the common sense preparation of carefully designed plans, and the application of such plans to an area of considerable size in order to promote the economic, social and general welfare of the region. County planning may be identical with or a part of regional planning.

Growth of Regional Planning.—Regional planning is the logical outgrowth of the city planning movement, which began in this country some twenty to twenty-five years ago, and which was made necessary by the congestion of population in our larger cities. Social and economic problems pertaining to the public welfare always follow the crowding of human beings into small areas; tenements and slums, with their attendant uncleanness, ill health and lack of attractiveness to either resident or visitor, are the inevitable results of such crowding. Forward-looking men and women of two decades ago sensed that something was wrong with the trend of city development. They also found that the average individual living under conditions existing in crowded cities was almost powerless, through



Howell Ave., Milwaukee, Showing Buildings Set Back Under Highway Right-of-Way Widening Ordinance, Allowing Plenty of Width for Future Widening of Highway

circumstances, ignorance or lack of initiative, to help himself in bettering surrounding living conditions. The problem was more than individual—it was municipal. So gradually, by way of remedy, certain measures of public

control were devised, such as zoning, street widening, building set-backs, the creation of parks and playgrounds, control of new developments and other measures of a similar nature generally known today under the title of "city planning."

The experience of a few years proved that there was considerable merit to city planning, if these measures were applied practically. It was not a cure-all but it did help greatly. The result was that many municipalities, particularly smaller cities, began to study and adopt city planning, not so much as a curative measure, but as a preventive of future undesirable development. Today city planning has become a part of progressive municipal government.

Where twenty years ago there were problems of congestion within municipalities only, today we are faced with the additional problem of the congestion of municipalities. The widely separated villages of the metropolitan area of the past are the adjacent cities of today, and in many instances a new crop has been added to fill up any vacant spaces that might otherwise have been overlooked. Thus we find cities and villages crowding and push-



Howell Ave., Milwaukee, Showing Old Buildings Constructed Before Highway Right-of-Way Widening Ordinance Was Adopted. The Ordinance Now Prevents Situations Similar to This from Occurring

ing one another and competing for space in which to grow. Cities and villages are not merely names upon a map, they are an association of individuals living in one community. They are alive, thrusting out an arm here or a leg there. Crowding is as irksome to municipalities as it is to individuals, and a spirit of irritation and resentment often arises, which prevents cooperation in the preparation and execution of plans for public improvements.

In many instances cities and villages are so engrossed with their own local problems that little or no thought is given to municipal improvements planned by their neighbors, and even if such matters were given consideration by any one municipality, it is very doubtful if the plans proposed would be adopted by the other cities and villages of the region.

Again, while cities and villages are dealing with their individual problems, another very important part of any metropolitan region is often entirely ignored, as far as planning is concerned. This portion is the unincorporated area lying outside the corporate limits of cities and villages. Such instances of neglect as the preceding, unfortunately, are numerous. It is the general public that suffers as a result, and this is why real cooperation is needed.

Just as city planning was brought forth to coordinate development within the city proper, regional planning has been advanced within the past few years to coordinate improvements of the individual municipalities of the metropolitan region, and bring order



Signs Such as This One, Posted Along the Highways in Milwaukee County, Give Notice of the Established Width

out of the chaotic form of development often existing in areas lying beyond such corporate limits.

Form of Regional Bodies.—The agencies of regional planning take various forms. Sometimes they are municipal bodies, sometimes they are supported by popular subscription and in other instances they may be a combination of both.

Some outstanding examples of regional planning in the United States are the following:

The Regional Plan of New York and

Its Environs, extending its influence not only over cities and counties, but over parts of three states.

The Tri-State Federation of Philadelphia, likewise extending into three states.

The Niagara Frontier Planning Association in the vicinity of Buffalo, Tonawanda and Niagara.

The Chicago Regional Planning Association, active within a fifty-mile radius of the loop in Chicago, covering parts of Wisconsin, Illinois and Indiana.

The Greater Kansas City Regional Planning Association, recently organized by six counties in the vicinity of Kansas City.

The Los Angeles County Regional Planning Department.

The Milwaukee County Regional Planning Department.

Of these regional planning bodies, the two latter are the only strictly municipal regional planning departments, each being organized and financed entirely as a county department.

Functions of a Plan.—Those not familiar with the purpose of regional planning may inquire as to what its possibilities are. The answer is that the possibilities are almost unlimited. A few of the more important undertakings in which regional planning may be of value, either directly or in an advisory or cooperative capacity for the development of the metropolitan area, are the following:

A water system.

A platting system.

A highway system, including a system of major thoroughfares.

A park and parkway system.

A system of recreational centers and playgrounds.

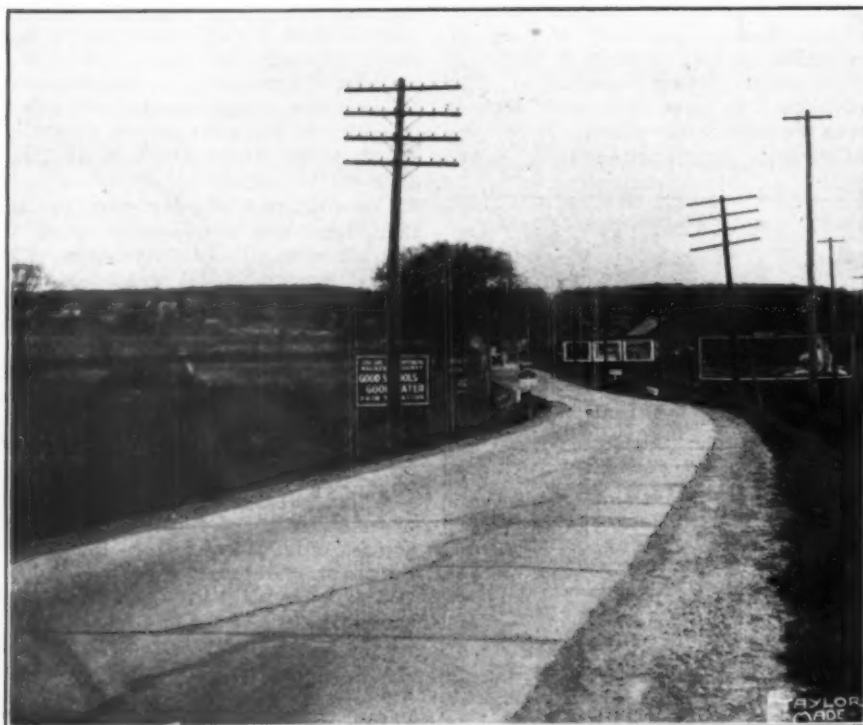
A transportation system.

A zoning scheme.

The coordination of these activities.

Where a region is extensive in size, county planning may be a part of regional planning. Where the region is covered by one county, as for example in Los Angeles County, Milwaukee County and Lucas County, Ohio, the boundaries of the county and the region may be identical. Usually there are several planning agencies operating independently within the region. Such agencies may be city, village, township or county. The regional planning body may be merely advisory to the existing governments, or it may be delegated both to plan and to carry out its plans. Those regional planning associations financed in whole or in part by general subscription are, for the most part, advisory to the various governmental units which comprise the region. On the other hand, the regional planning departments which are a part of county government, financed and governed as such, are in a position not only to create plans, but to supervise their execution as well.

Planning in Milwaukee County.—Regional planning in Milwaukee County really began in the year 1908, with the



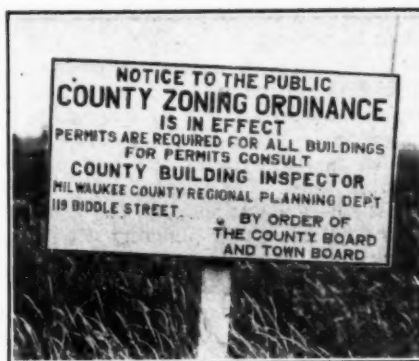
Blue Mound Road, Milwaukee County, Before the Construction of the Superhighway. A 120-Ft. Right-of-Way Made Expansion Easy

appointment and organization of the Milwaukee County Park Commission, since the law authorizing the appointment of park commissions in Wisconsin provides that where a park board exists, it shall also function as the rural planning board. The County Park Commission, therefore, became one of the first regional planning bodies in the country, although under another name. Some time later the Milwaukee Metropolitan Sewerage Commission was organized; this commission has developed a complete system of sanitary sewers and a disposal plant to take care of the sewage in that area within the county lying within the watershed of the Milwaukee, Menomonee and Kinnickinnic rivers. The sewage from each city, town or village within the area is carried to one central disposal plant and the cost of treating is charged back pro rata to the various municipalities, according to the amount of sewage treated from each. This is an illustration of a real regional project.

From 1919 up to the present time rapid development has been taking place in the outlying sections of the county, and in 1923 the County Park Commission, acting as the rural planning board, called the attention of the County Board to the confusion existing in development of the areas intervening between the cities of the county. The Park Commission, seeking relief, petitioned the County Board for the creation of a Regional Planning Department. The County Board acquiesced in the request of the Park Commission by placing in the budget for the year 1924 a sum to finance the creation of the Regional Planning Department, and the department began to function in March of that year.

At the time of the organization of the Regional Planning Department, there were three major activities placed before it for consideration: Development of a proposed county parkway system, regional platting and zoning of the county. In addition to these major activities, several almost equally important activities have since been added, among them being highway right-of-way widening, park engineering, landscape work for the county institutions and other work of a similar nature, so that today the Planning Department may be considered as partly a planning department and partly a department of public works putting into execution the plans which have been devised.

Most of the work engaged in by the County Planning Department relates to activities carried on outside of the corporate limits of cities and villages of the county. Those activities having to do with cities and villages in the county are carried on through cooperation with the governing bodies of the various local municipalities. One feature of all county planning laws in Wisconsin is that major projects can be undertaken by the county, but it is necessary, before such projects become effective, to



Sign Notifying the Public That the County Zoning Ordinance Is in Effect

have the approval of the governing body of the municipality in which the improvement lies. The town and city governments in the county have given exceptional cooperation in these matters.

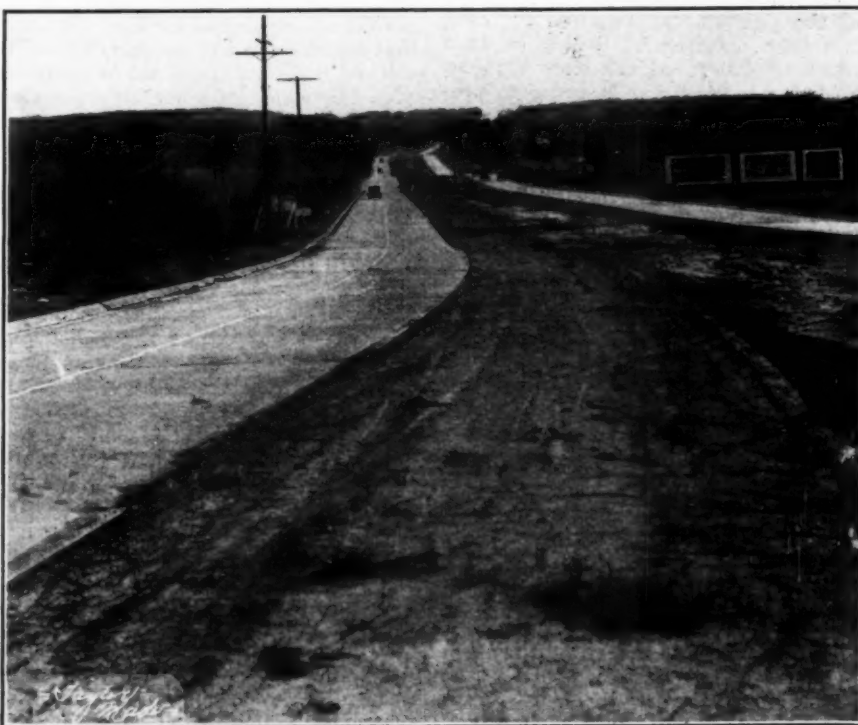
Right-of-Way Widening.—The most important of the county planning activities are highway right-of-way widening, county zoning, the parkway system and platting guidance and control. It may be of interest to discuss each briefly.

One of the most interesting problems before the department has been the matter of highway right-of-way widening, or the creation of a major thoroughfare plan, since so much of planning is dependent upon the plan of major thoroughfares. At the time of the creation of the department it was realized that additional widths were needed upon certain of the main highways, and it was found that the aver-

age subdivider, when asked to dedicate a width in excess of the existing width, did not object so much to dedicating the land asked for as he did to the lack of assurance of uniformity in dedication. If one owner dedicated land for a width of street of 110 or 120 ft., he wanted assurance that when his neighbor platted the same width would prevail, so that the ultimate width would be uniform on both sides of his holdings. This request on the part of the realtor seemed reasonable, and as a result a bill was drafted, and passed by the 1925 session of the Legislature, authorizing the County Board of Milwaukee County, with the approval of the individual town boards of the county, to establish a width in excess of that then actually in use. Prior to the passage and application of this law the city of Milwaukee had done some excellent work beyond the city limits in obtaining a greater width of right-of-way by persuasion, but an established plan was necessary to make the effort wholly effective.

With this law as a basis, a plan was prepared for a system of major thoroughfares and this was adopted as an ordinance by the County Board in June, 1926. The law provided that a copy of the ordinance be filed in the office of the Register of Deeds, and as soon as the ordinance passed it was filed, and then entered in the tract index applying to those quarter sections of land affected thereby.

The operation of the county highway right-of-way widening ordinance has been very successful. The ordinance as applied in Milwaukee County does not constitute the taking of land for the



Blue Mound Road After Construction of the Superhighway. The Two 20-Ft. Slabs May Eventually Be Expanded Into a Continuous 90-Ft. Pavement

additional width of right-of-way required, but it is in effect a declaration of intention upon the part of the county to provide ultimately a street or highway of the width specified. Like all county planning matters, it was deemed advisable that the general public be fully informed of the existence of the widening ordinance, and as a result wooden signs were prepared and placed along the highways specified in the ordinance. These signs state the established width of the highway and warn prospective builders to keep buildings back of the newly established width. With a definite understanding of the width established, it has been found that no one will intentionally erect a building within the future public right-of-way.

Planning Saves Money.—In the matter of highway right-of-way widening, the county has two additional checks upon building location: one is the fact that permits are required for the erection of buildings, and no permits will be issued unless the proper setback is observed; the other check consists of the requirement that all plats be approved by the County Board before being recorded. Through control of platting, many miles of widened highways have been obtained. To date, property owners have dedicated in excess of fifty miles of widened highway on plats of record. By obtaining wide rights-of-way at the time of platting, and by keeping buildings back from the street line along narrow rights-of-way, the taxpayers of Milwaukee County are being saved many thousands of dollars.

Some idea of such saving may be obtained by considering the cases of Blue Mound Road and Capitol Drive. Part of the right-of-way required for each had been obtained by dedication to a width of 120 ft. at the time adjacent land was platted, but in order to proceed with the construction of the contemplated superhighway it was necessary to obtain at once that land which had not already been dedicated. The additional land required was also obtained by dedication, except that it was necessary in this instance to pay damages for existing improvements, such as fences, trees, buildings, wells and so forth, and for small parcels of land where it was evident that no benefit could be shown as a result of the widening.

On Capitol Drive the total length of road remaining to be acquired was 3.07 miles. The amount of damages was somewhat over \$60,000, or approximately \$20,000 per mile. On the Blue Mound Road the total length of the road remaining to be acquired was 2.54 miles. The cost was over \$75,000, or approximately \$30,000 per mile.

Averaging these costs, we find that the right-of-way cost for damages to improvements on roads of this type, under present conditions, amounts to in excess of \$25,000 per mile. In a few years more the cost of improvements

alone would be many times the amount paid at present.

Using these figures as a basis, the fifty miles of widened highway obtained by the county to date by dedication in platting is worth at least \$1,250,000, which is many times the cost of obtaining such dedications, and many times the amount spent in the last five years on all county planning activities.

The plan of widened highways has become so fixed in the mind of the general public of Milwaukee County that a system of major thoroughfares at a minimum cost is now assured.

Zoning Part of Plan.—An outstanding accomplishment of county planning in Milwaukee County is the zoning ordinance adopted by the Board of Supervisors in October, 1927. It is one of the first county zoning ordinances to be adopted in the United States, and its passage followed nearly two years of preparatory work.

The Wisconsin enabling act, at the time of the preparation of the zoning ordinance, permitted the establishment of Use Districts only, and by the zoning ordinance Milwaukee County has been divided into the following seven classes of Use Districts:

- "A" residence district.
- "B" residence district.
- Local business district.
- Agricultural district.
- Commercial and light manufacturing district.
- Heavy industrial district.
- Unrestricted district.

The various districts created do not differ greatly from those found in the usual zoning ordinance except that the creation of an agricultural district under the zoning ordinance does not mean that this district will be limited to agricultural use, and should not be confused with the policy of some city planners in attempting to establish permanent agricultural belts around or surrounding city development. The agricultural district is composed of lands from which industry will be permanently prohibited, and which will continue in agricultural use until the time comes for the development of these lands as urban or residential areas. In studying the application of zoning to country districts, it was apparent that certain of these outlying sections should be retained for residential purposes, and that industry should be excluded therefrom. It was not deemed advisable, however, to go away out into the country, where development is from twenty-five to fifty years distant, and attempt at this time to fix the exact location for future business. It is expected that, as metropolitan Milwaukee grows and land changes from farms to subdivisions, local business districts will then be laid out at the most logical points. The residential area, through amendment of the zoning ordinance, will, from time to time, be extended into the agricultural district so as to maintain a proper

balance of residential and local business zoning.

In order to administer any zoning ordinance properly, it is necessary to have a building inspector, who will issue permits for buildings about to be erected. It is also desirable to have a board of appeals to take care of the border-line cases continually arising in connection with zoning. Legislation permitting the county to appoint a building inspector and a board of appeals was obtained at the 1927 session of the Legislature, and an ordinance was passed by the County Board creating the office of county building inspector. Since that time permits have been required for all buildings erected in the county.

In interpreting and applying the provisions of the zoning ordinance, it is intended that such provisions should be held to be the minimum requirements for the promotion of health, safety and the general welfare. By careful administration of the ordinance it will be of immeasurable help in the development of the county and of inestimable value to the people of the community.

Parkways Prevent Stream Pollution.—Development of a parkway system is essential in any program of county or regional planning, as one of the most serious problems confronting any community is the care of its surface or flowing water. Streams must be kept clean or they will become polluted. There does not seem to be any halfway ground—it will be one way or the other. The time to provide for the preservation of streams is prior to the time when urban development may choke and pollute them. It is a matter of regional planning. Streams run from one town to the next. A stream polluted in one village does not become clean by simply crossing the next town or village line. Stream preservation and conservation are among those things which can be accomplished only by the larger units of government. The individual whose holdings border on the stream has no control over what his neighbor is going to send down upon him. With thousands of ownerships abutting our streams, we have thousands of potential sources of pollution. The banks of our streams or flowing water should not be built upon. They should be under public control and have public care and preservation. When our modern civilization extends to the point where it occupies the stream banks and the low places adjacent to the stream, it generally takes the very poorest form of development. The original beauty of the stream is destroyed. It becomes a refuse dump, a breeding place for flies, mosquitoes and disease. The proper way to remedy this is for the municipality to obtain control of the stream banks prior to the time of city development, and to create along them parks and parkways. Such land is particularly adaptable for parks and parkways. A stream properly handled adds

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very much in the way of charm to a park or parkway, but ordinarily has all of its charm removed when encroached upon by subdivision development. Throughout not only counties, but entire states, we find innumerable places where roads parallel streams, and where the banks of these streams could at this time be readily obtained at small cost, and if maintained in a natural condition, would lend a great amount of beauty to the highway system. A study will prove that the preservation of the natural state of our streams will pay dividends by increasing the value of property near them, in addition to improving sanitation and maintaining the scenic value of our highways.

Milwaukee County has adopted a tentative 84-mile plan of parkway development, and land acquisition and construction are now under way. The County Board has established a definite policy with respect to land acquisition. Land for parks is purchased outright by the County Board and paid for out of general taxes. The county park system to date consists of some 1,800 acres of land; in addition, from five to six hundred acres are now under option or are being condemned for park purposes. The county parkway system, on the other hand, is financed entirely through dedication of the land required, or by acquisition of the land through an assessment of benefits and damages. To date, land for two and one-half miles of the parkway system has been dedicated along the Menomonee River. The necessary right-of-way for over a mile of parkway system has been tendered the county on the Root River. The County Park Commission and the County Board now have under consideration the acquisition of five additional miles of parkway by condemnation, and an assessment of benefits and damages therefor.

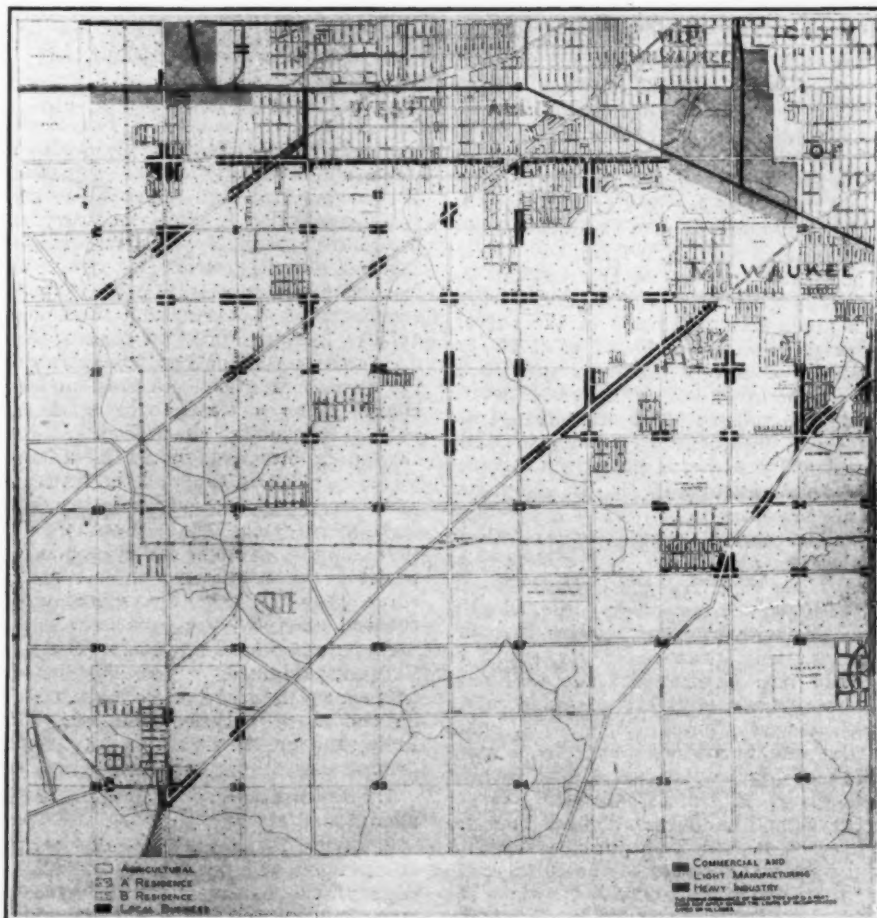
The most perplexing problem with relation to parkways is to give the public some idea as to what is meant by a parkway. In order to show what a parkway really is, the county is now building the first parkway unit, which will be over two miles in length when completed, and part of which will be finished this year. The results of this construction are noticeable already, as far as public opinion is concerned. Since this project has been undertaken, and it is possible to visualize the appearance of the future system, there has been an increasing demand for parkway construction in other sections of the county.

The Importance of Platting.—Platting is another extremely important element of regional planning. Subdivisions are not remodeled every year. Very seldom, if ever, are they scrapped and made over, because once land is subdivided into small areas, and homes and stores are built thereon, it is very difficult to effect changes, and it is probable that the layout devised at the time

of platting will continue to exist for a great many years to come—perhaps for hundreds, perhaps for thousands of years. In far too many instances land is subdivided with little thought of the importance of the plat in the development of the future city.

In Milwaukee County no plat within cities or villages can be recorded without the approval of the governing body of the city or village in which the land lies. Likewise, in an area within a mile and a half of the city of Milwaukee no subdivision can be recorded without the approval of the governing body of the city. To cover the bulk of the outlying area there is a law which states that no plat outside the limits of incorporated cities and villages can be recorded until it is platting to the satisfaction of the County Board. This law has far-reaching results in its application. The County Board will approve no plat that has not first been approved by the Regional Planning Department. In this way an absolute check is had on all plats submitted. The experience of the department has been that the average subdivider or engineer is reasonable, providing he has a reasonable body with which to work. From local experience it was found entirely impractical to establish a policy of rejecting plats that the engineers had spent considerable time and money on, and

to require that they be entirely revised. A better method of handling the situation was worked out. It was found that by preparing in advance platting schemes or studies for large areas, containing as a minimum a quarter-section of land and preferably several quarter-sections, a scheme of platting could be devised, which under ordinary circumstances would be found practical. The county has already determined the width and location of the main highways and the main diagonals desired. Generally the main highways are the boundaries of a quarter-section. With a system of main highways worked out, it has been possible to develop a plan for secondary streets. Such plans are based upon actual topography covering the area under consideration. Topography to an interval of 5 ft. has been taken over about two-thirds of the county to date. Now when a prospective subdivider is about to plat, usually the first thing he does is to seek a platting layout, which is furnished him by the department. The main highways shown on this plat cannot be changed as to location or width. The secondary system of streets is subject to change to suit the subdivider, providing such change will not be detrimental to the general layout and to the general welfare. By the use of this method, the subdivider knows where he stands at



Zoning Map Showing Use Districts, Town of Greenfield, Milwaukee County, Wisconsin

all times, and in general it is satisfactory to both the county and the subdivider.

Cooperative Spirit Found.—County planning, or regional planning as it is called in Milwaukee County, is being carried out on a basis of cooperation as far as possible, and the cities, villages and towns of the county have shown great willingness in giving their whole-hearted cooperation.

The results of any planning activities are not noticeable immediately but, based upon local experience, it seems safe to say that a county is the logical body for the carrying on of planning activities in those areas beyond the corporate limits of a city or village, since usually all cities, villages and towns are represented in the county government, and therefore under county government better cooperation and better results can be obtained than under any other arrangement of planning control. In a large region where it is essential that the function of the regional planning body extend over several counties, county planning should be a part of the regional plan, supplementing the work being done by the village and city planning bodies of the region.

Acknowledgment.—The foregoing paper was presented at the Milwaukee convention of the American Society of Civil Engineers.

Curve Widening in California

The Division of Highways of the State Department of Public Works of California has recently adopted the policy of widening the pavement and roadbed on all curves having radii of less than 500 ft. We are indebted to the September issue of California Highways and Public Works, the official publication of the department for the following details: The widening which is applied to the inside of the curves, varies from a minimum of 2 ft. for curves of 400-ft. radius or greater to a maximum of 4 ft. for curves of 200-ft. radius or less. The transition from normal unwidened roadway to fully widened roadway is made in a distance of approximately 80 ft. In every case the pavement edges follow mathematically precise curves which insure pleasing appearance and are easy to lay out.

The widening policy has been adopted in line with the best modern highway engineering practice in an effort to build into California roads the maximum degree of safety, ease and riding efficiency. Curve widening is being practiced in various forms by a number of highway organizations usually, however, in connection with sharper curves and narrower roadbeds than are used on modern state highways. With the general adoption of the 10-ft. width for single traffic lanes, 20-ft. width for two-lane pavements, wide shoulders, moderate speed limits, and definite restrictions of vehicle dimensions,

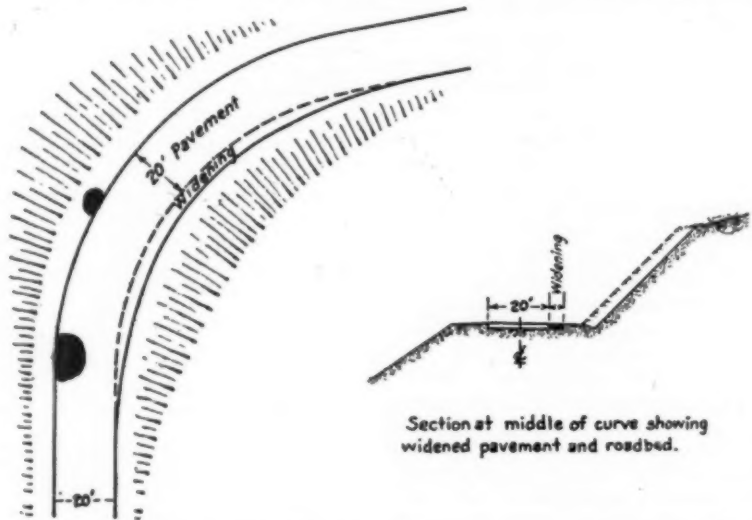
curve widening seemed unnecessary. In the last year or two, however, speed limits throughout the country have undergone decided upward revision in response to popular demand.

A properly aligned and superelevated curve produces at reasonable safe speeds, little or no steering effort or swerving sensation. A passenger riding with eyes closed should be practically unable to distinguish between straight and curved road. Various driving tests indicate that on properly superelevated curves of about 1000-ft. radius or more a car can be guided safely without appreciable effort at any practical speed within a 10-ft. traffic

curve. The approximate length of 80 ft. for the widening transition was selected carefully with a view to securing a combination of the most natural, convenient, and economical transition for average, reasonable, practical speeds. Safety and driving ease are thereby increased.

3. In case a car traveling at excessive speed does lurch, additional passing room is provided on the outside of the curve, toward which the car will swerve. The additional width allows more room for maneuvering the car and so adds safety.

4. Greater clearance, with increased safety and beneficial psychological



Plan and Section Showing Widening of Pavement and Roadbed on Curves

lane. On curves of from 500 to 100-ft. radius the steering effort and sensation of curving become appreciable and speed restriction is often necessary on the shorter radii if the driver is not familiar with the road. On curves of less than about 500-ft. radius speed restriction is necessary and there is a definite lurching effect at high speeds due to the sudden change from straight to curved progress. A too sudden change from a straight to a curved path is productive of accidents. The change in direction should be accomplished gradually to avoid the lurching and weaving tendencies. It is to assist in this easier change of direction and to eliminate as much as economically possible the hazard which the sharp curve presents, that the widening of roadbed and pavement are introduced.

Standard widening as applied to California highway curves modifies or overcomes the tendencies encountered on the sharp curves within practical limits and provides greater safety and driving ease in the following ways:

1. Sight distance is increased, which adds to safety.
2. With the aid of a traffic stripe 10 ft. from and parallel to the inside edge of the pavement, traffic in both lanes is directed along a path which corresponds closely to a parabolic transition between straight line and

effect, is provided between passing vehicles of unusual width.

The actual design of the widening is based on a careful study of modern contemporary practice and represents the best efforts of the engineers of the California Division of Highways to incorporate into their highway designs the maximum of safety and service for present and future automotive traffic, with due regard for the high speeds which almost surely will prevail in the future.

Right-of-Way for Government Officials

There are no red lights to stop the progress of high officials of the government along the beautiful Avenida Rio Branco in Rio de Janeiro, Brazil. Officials arriving at the dock ride the full length of the prominent thoroughfare to government headquarters without a single stop, for a special control has been installed for stopping traffic from entering from side streets on such occasions. Another special control is employed to have all signal, both thoroughfare and side street, red to give the right-of-way to the fire department. The traffic control system, supplied by the International General Electric Co., employs red, green and intermediate amber lights. Left turns are generally prohibited, and most streets are limited to one-way traffic.

Reasons and Methods for Making Traffic Counts

Experiences at St. Louis in Making General and Special Counts and How the Data Obtained Are Used in Traffic Control

By REYBURN HOFFMAN

City Traffic Engineer, St. Louis, Mo.

STREET traffic is the life blood of a city. The city's pulse can best be watched by checking periodically the flow of traffic. In what better manner can we reduce congestion and prevent hardening of the arteries than by keeping close check on the movement of this life blood?

Because vehicular traffic is fluid and is in large measure a result of habit, it is always susceptible to influences which change its volume, its periods of flow and in many cases its routes. The reconstruction of a street, the widening of a roadway or the elimination of a jog will change completely the habits of thousands of drivers. It is essential therefore that the counting of traffic should be a continuous affair, if we are to keep our finger on the traffic pulse.

How Traffic Counts Are Made.—Because of their close relationship we have chosen to discuss the reasons as well as methods for making traffic counts.

First let me explain under what circumstances our counts are made and classify them. We make what might be termed general counts and special counts. The terms are self-explanatory but the ways and means might be elaborated upon.

During the months of January, February and March, practically all contract street work is at a standstill. As a result there are available between 15 and 20 construction inspectors who would otherwise be idle.

By the arrangement of Robert B. Brooks, Director of Streets and Sewers, these men are loaned to the Traffic Division and are put to work counting traffic under our direct supervision. These men make our general counts.

The special counts are made by our own traffic inspectors, who do this aside from their regular duties as needs arise.

The men making the general counts are paired off and alternate between morning and afternoon watch, unless by mutual agreement they wish to work all mornings or all afternoons.

This makes 5½ hours shift, which might appear to be short, but we know from experience that counting and classifying traffic requires concentration and is tiring. With fatigue comes relaxation and carelessness, so that shorter hours result in better results.

Counts are made straight through the week, except Saturdays and Sundays, between the hours of 7 a. m. and 6 p. m. for an 11 hour count, each man counting half the period, and only a severe

blizzard or below zero weather interferes.

During the past two years, which includes three periods of January, February and March, we have made full time counts at over 300 intersections, representing in man hours an expenditure of \$25,000. This would have been impossible if we had been required to hire these men out of our traffic budget.

We have made counts at every important street intersection in the city, within the congested district, comprising over 100 intersections, and also along the various streets in the Major Street Plan which comprise 25 per cent of the total street mileage, or about 250 miles.

We now have a structural flow map of the entire city and one of the central business district.

What the Traffic Flow Maps Show.—These two traffic flow maps: (1) Major Street Structure and (2) Downtown Business District, provide valuable backgrounds for much study and planning. The major street flow map tells at a glance where the volumes are distributed and indicates those intersections and focal points where the big problems are, or will be. Analysis of the tally sheets shows the hours of conflict between opposing lines of traffic.

The flow map of the downtown district tells another story, and has been of value in studying downtown street car rerouting plans, in determining the need for additional roadway capacity by reconstructing old streets and setting back the curbs, the need for additional outlets and also in considering our parking problem. These data clearly show the streets along which parking has become a nuisance.

We believe that a picture conveys more information than an array of figures. For that reason all traffic counts are plotted to scale and the various maneuvers are indicated by bands of proportionate width. All intersection flow maps are made at the scale of 8,000 vehicles to the inch.

By adhering to a standard scale it is easy to make comparisons between flow diagrams of any number of intersections. These usually tell the story. For any further details we refer to the summary sheets or to the original tally sheets from which we may analyze the details.

Recording the Traffic Counts.—The number of men assigned to any location depends of course upon the volume of traffic and the information desired on the tally sheets.

Our assignments vary from one man to four men and the tally sheets are collected from each man each day and his new assignment made.

These tally sheets are brought into the office and tabulated immediately and a separate sheet made of the summary.

Our detail sheets are printed with the following columns: one horse, two or more horses, passenger autos, light trucks, heavy trucks and street cars. If we count on a bus line we use the street car column. As additional information we show the weather, and the kind of paving.

All counts are broken up into half hour periods and in some cases fifteen minute periods. These smaller divisions of time are especially desirable during the morning and evening peaks, because a difference of a few minutes makes a big difference in volume.

Traffic Volume Result of Habit.—We made two counts at Pine and Lawton, one week apart. The writer helped out during the period between 4 and 6 p. m. both times, and was completely convinced of the assertion that traffic volume is the result of habit. I recognized personal acquaintances, prominent citizens and cars of distinguishing characteristics, streaming by during the same time period on the same day of the week one week apart. I know their offices to be blocks apart, some on the east edge of the downtown district and others employed as far west as Fourteenth St.

This experience along with others convinced me that simultaneous traffic counts over large areas are not necessary. There is one exception and that is in the making of an "origin to destination" check.

The congested district count supports this stand. This count spanned three months and reference to any two adjoining intersections will show surprising agreement although they may have been counted over a week apart.

Some questions may be raised regarding the time of year—the three worst months. As previously stated, we cancelled counts only in the most severe weather, in consideration for the men themselves.

The traffic on the streets during inclement weather is essential traffic, no pleasure riding. We have made comparisons of winter and summer counts and found the summer increase to vary between 25 per cent and 40 per cent over the winter months.

Traffic Before and After Street

Widening.—We had the opportunity to make some interesting before and after counts on Olive St., which was opened a year ago as a 100-ft. thoroughfare with a 76-ft. roadway, having been widened from a 60-ft. street with a 36-ft. roadway with double car tracks.

The original count of 1927 showed 1,600 vehicles per 11 hour day. At a period when the new car tracks had been laid and paved there was available a free lane in each direction and the volume increased to 5,000 per day. After the street was completed 13,000 vehicles used the street each day, and the most recent check shows around 16,000 or ten times the original flow.

While making these counts we also checked the adjacent parallel streets both north and south, leading into the business district with some interesting results.

The street most seriously affected was Locust St. This street showed a decrease of 26.5 per cent. This can be explained by the fact that Locust is connected to Olive via a cut-off one block east of its western terminus, a dead end. Most of the Locust traffic originated at its intersection with Olive, hence, when Olive was opened the easiest way was to use Olive St.

The two adjoining streets to the south showed about 5 per cent decreases, while the third one south remained about uniform. The remainder of the increase in Olive St. comprises additional traffic encouraged by the new thoroughfare, and those vehicles which ordinarily entered either from the north or south, but which now avail themselves of this new entry into the business district.

Without discussing these streets in further detail, the object of this is to show the value of making before and after counts.

Then too, this information has been used in the timing and regulation of traffic under our new signal system for Olive St. In this connection we have made counts of cross traffic volumes, of the time it takes various types of vehicles and also pedestrians to cross this 76-ft. roadway. The times for different crossings are as follows:

	Seconds
Pedestrian	14.3
Passenger autos	6.1
Light trucks	6.5
Heavy trucks	9.2
Street cars	10.7

In another instance we made a special count to see the effects of extending the paving on an important street. This is at the intersection of Twelfth Blvd. and Russell Blvd. The paving of Twelfth originally ended here, which resulted in both left and right turns which we knew were avoiding the unpaved street. Counts were made before and a year later to the week, during which time the street had been paved. The results are interesting. Traffic increased from 458 to 2,562 vehicles, or 457 per cent.

These volumes are not particularly imposing but the increase unquestion-

ably indicated to us that a proposed cut-off one-half mile south was justified; in fact that it should be pushed to early completion.

Similar study counts have been made at other places throughout the city, each one developing valuable facts.

Another study count was made farther east, at Seventh Blvd. and Russell Blvd. A center type "Stop and Go" signal had been wrecked by a drunken driver. This signal prohibited left turns, but it had always been more or less apparent that this restriction was a hardship. Both streets being boulevards and requiring stops, we decided to leave the signal down, put up Boulevard Stop signs and watch results. Everything went serenely along, the necessary left turns were made much to the relief of Broadway, one block east. The probability is that it will be a long time before the signal is replaced, and if so, left turns will be permitted. Here is a case where a before and after count verified our suspicions and supported opinions with facts.

Traffic Counts and Traffic Signals.—As important as counting traffic is the job of keeping a continuous record of accidents. Traffic volume and traffic accidents are the two major factors in the determination of the need for automatic or officer control.

The St. Louis Safety Council keeps a card index of all accidents reported by the police. It is from these records that we get our accident information.

Those of you who are vested with the responsibility of placing signals, designating Stop Streets or Stop intersections, and who must continually be explaining why there should be no signal here or there, fully appreciate the value of full traffic counts from which comparisons may be made.

We all know that "Stop and Go" signals have been installed promiscuously. Detailed traffic counts and proper analysis of the facts obtained will help keep this practice down to a minimum.

Furthermore, a count is necessary to determine the methods of regulation and the timing of the periods if the installation is to be at all scientific.

A series of accidents at an intersection usually results in unreasonable demands for "Stop and Go" signals, and it has only been possible to stave off this demand because facts were available or made available soon by a study of conditions.

For instance, at McPherson and Newstead a jog had been eliminated and a large throat resulted on the north side. The result was corner cutting and smashups. The clamor was for "Stop and Go" signals, which upon the face of it would be a mistake.

After traffic counts, investigation of accident reports and the laying out of a dozen schemes, the simple expedient of two flashing beacons and some center

lines reduced accidents to one-sixth of their original number.

"Stop and Go" signals would have been a hindrance to traffic and a perpetual expense to maintain.

Having since been made a Stop intersection, the beacons have been removed. All we have invested there now is the cost of two signs, four mushrooms and a couple of hundred metal roadway markers. Needless to say, traffic counts are good investments.

Standardizing Traffic Counts.—With the continued efforts, with some results, to standardize in all things pertaining to traffic, the time is at hand when we should be thinking about following certain standards in the making and digesting of traffic counts. That is, we should if those in the various widely scattered cities wish to make comparisons and arrive at standards which mean anything. A common denominator, so to speak, is needed.

First: We must decide on what constitutes a business day, is it 7 a. m. to 6 p. m., 7 a. m. to 7 p. m., or 8 a. m. to 6 p. m.?

Second: We must talk in terms of volume per lane; 30,000 vehicles a day doesn't tell the whole story; there may be two lanes or four lanes.

Third: We should develop certain factors for computing ultimate capacity per lane. This would involve roadway width, street car streets, streets having a predominance of fast traffic or slow traffic, and possibly types of pavements.

When we can decide upon the above or similar standards we will be approaching a basis for comparison which will mean the same in New York, Chicago or St. Louis.

Just who shall take the initiative, the speaker is not able to say. With such agencies such as the Street and Highway Safety Conference, the American Engineering Council and the National Safety Council in the field, it would seem that this question can be answered.

Acknowledgment.—The foregoing is a paper presented Oct. 4 at the 18th annual Safety Congress.

Sod Protects Roadway

Laying of 70,000 sq. ft. of sod along the State highways throughout Pennsylvania has just been completed by the Department of Highways, John W. Keller, Forester, reports. The sod was placed at the entrance to culverts, and on steep slopes where excessive erosion has caused great expense and inconvenience. Sodding is done under the supervision of the assistant division foresters and the sod is purchased locally wherever obtainable. This year the average cost of laying the entire quantity was \$.072 per square foot. The largest quantity was laid in Division 6 where 21,000 sq. ft. were put down.

Street Paving Job Requires Much Rock Excavation

New Jersey Contract Calls for Moving 80,000 Cu. Yd. Rock

By LESTER H. BURNS

THE stringing of the first cables between the New York and New Jersey piers of the Hudson River bridge has stimulated renewed construction activities in the New Jersey towns adjacent to the bridge approaches.

The borough of Fort Lee, one of the towns affected, has recently let a contract for the construction of new streets to the Clinton Asphalt Co. of Union City, N. J. This contract calls for the construction of four miles of sewers, 74,600 sq. yd. of pavement, 164,000 sq. ft. of sidewalk, and eight miles of concrete curb. The bid of the Clinton Asphalt Co. was \$1,300,000. Six other contractors submitted bids, the proposals ranging up to \$1,800,000.

The section through which the roads and streets are being built is practically virgin territory. The major portion is rock, with very little overburden. Some idea of the work involved can be gained from the contractor's estimates of the type of spoil and the amount to be removed. The total amount of rock to be removed exceeds 80,000 cu. yd., while the unclassified spoil will not exceed 14,000 cu. yd. The rock is hard traprock and is part of the New Jersey Palisades formation. According to the United States Department of Geology, this rock is the finest of its type to be found any place in the United States. It is a highly desirable aggregate for concrete, because of its extreme hardness. It is used through-



Drilling the Hard Traprock with Compressed-Air Hammers

out the state of New Jersey for many construction purposes.

McClave and McClave, the borough engineers, laid out the streets to be improved and constructed. The general plan ties up with the anticipated flow of traffic to and from the bridge. Since much of the traffic will flow north and south to the lower Bergen County towns and those of Hudson County, the north

and south streets will be wide boulevards to allow the traffic to flow smoothly.

The bridge approach proper, on the New Jersey side, will be in the form of a circular plaza, which will be named Hudson Plaza. From this Plaza, the streets and approaches will radiate in all directions, connecting the Plaza with the main state and county local and express highways.

A quarter of a mile to the south of the plaza, the new section under construction will be reached by means of the new north and south boulevards. At the present time, only one improved highway from the south to the bridge serves the traffic from lower Bergen County. When the improvements have been finished, this traffic will be served by three additional avenues, which parallel Anderson Ave. These four roadways will converge at Hudson Plaza, and will take care of any increase in traffic for many years to come. The new north and south roads to be constructed are New Palisade Ave., Abbot Drive and Mackay Drive, so called in honor of State Senator Mackay, who sponsored and pushed the legislation for the construction of the bridge.

In addition to these through streets, many cross streets will be constructed, all planned to keep the normal bridge traffic flowing evenly and smoothly.

The entire construction at this time is due to the borough officers' realization that Fort Lee, because of its favored location close to the bridge, is



Removing Rock in Excavation for Pavement at Fort Lee, N. J.



Drills and Skimmer on Fort Lee Paving Job

destined to become an apartment house section. Many New York City workers will take advantage of the ease with which Manhattan Island can be reached, for, when the transit facilities are fully developed, this section will be nearer to Manhattan than parts of the Bronx and Brooklyn.

The sewers, ranging in size from 8-in. to 21-in. mains, will accommodate the people who will occupy the area.

The contract calls for the construction of four miles of new streets and sewers, catchbasins, and house connections. The streets will be paved with a concrete base with an asphalt wearing course 3 in. thick. The sidewalks will be 8 in. of cinders and concrete, and the curbs poured concrete.

The main street will be Abbot Blvd. Paralleling the Public Service trolley lines, this boulevard will be 80 ft. wide. The trolley tracks in the center will be in a parkway, and will separate the north and south lanes, which will accommodate three lines of traffic each.

Because of the absence of any appreciable overburden, the contractor could start drilling the rock immediately. As early completion of the work is required, the contractor has assembled all his equipment for rock drilling and removal. The rock drilling equipment consists of 20 Ingersoll-Rand portable air compressors, one of which is a truck-mounted unit. With so many portables operating, it was necessary for him to erect a blacksmith shop on the job to provide for a supply of sharpened drill steels at all times. The equipment in the blacksmith shop consists of an Ingersoll-Rand No. 50 sharpener and coke forge.

At the present time, the Ingersoll-Rand "Jackhammers" are busily drilling

along both sides of the trolley tracks for Abbot Blvd., where there is a considerable volume of rock. As the rock is drilled and blasted, it is loaded into the 5-ton trucks and hauled to the north of the workings, where it is used as fill. Under the contract, the contractor is to use all the spoil for filling the depressions within a semi-circular radius of 2,500 yd. In the event that there is not enough fill from the excavation, the contractor will get the required extra amount from the borough pit. For hauling and distributing this fill, he will be paid extra for each load and for the work involved.

As the rock is drilled and blasted, it

is loaded into a fleet of forty 5-ton Mack, White and Autocar trucks. The loading equipment consists of four Osgood steam shovels, one Austin crane, seven Universal cranes, four Erie gas shovels, three Keystone shovels, two Speeder clamshells, and one Thew Lorain 60A gas shovel.

When the fill is dumped at the desired places, one No. 16 and two No. 30 caterpillar tractors are employed to level it off.

The sewers of vitrified pipe are laid in trenches prepared as the excavating proceeds. All these trenches must be cut through solid rock, and in some places the trenches are 14 ft. deep.

As each section of the streets is excavated and the rock sub-base laid, the concrete base and curbs are put down immediately. For this work, a 27E Foote road paver is being employed.

The work was started in the first week in August and is about 25 per cent completed.

Chas. Schlossman is the chief engineer for the Clinton Asphalt Co. and A. L. Willgoose is the engineer in the field.

Seeding Roadsides in Pennsylvania.—Foresters of the Pennsylvania Department of Highways were busy with grass seeding during September, according to the monthly report filed by Secretary James Lyall Stuart. A total of 113,829 sq. ft. was seeded, on slopes and berms and the seeded areas mulched with straw, barn sweepings, burlap and cheesecloth to prevent erosion and enable proper rooting. Seeding operations were carried on in 32 counties, utilizing 560 lb. of seeds. The total cost was \$1,145.40, an average of \$.0098 per square foot.



Drilling in Advance of the Shovel

Street Cleaning and Refuse Collection

Organization and Methods of Department of Waste Collection of Cincinnati, Ohio, Which has Charge of Street Cleaning Operations and Waste Collection

REFUSE collections and street cleaning in the city of Cincinnati, O., are handled by Department of Waste Collection, of which Fred Maag is superintendent. Some interesting information on the operations of the department in 1928 is given in the recently issued annual report of Mr. Maag. The notes following are taken from the report.

This department serves over 136,568 families who live in approximately 80,600 dwellings, each with its individual problem of waste removal. These families live on about 958 miles of streets and roads, 583 miles of which are improved. In addition, the city is alive with industrial and commercial activities which, in many sections, contribute to the dirt in the streets.

Organization.—The general scheme of organization in the waste collection department divides the city into two divisions—Eastern and Western. Each division is in charge of an assistant superintendent who has supervision over all refuse removal and street cleaning work in his territory. These divisions are divided into four operating districts, each under the direction of a foreman, who reports to the assistant superintendent. The assistant superintendents report to the head of the department. A sewer cleaning division attends to the cleaning of all inlets, catchbasins and sewers, under the direction of a supervisor, reporting directly to the superintendent.

The department of waste collection renders the following services: The collection and disposal of household ashes and rubbish; the cleaning of streets, alleys and markets; the removal of snow and ice; the cutting of weeds on city property; and the cleaning of inlets and sewers.

During 1928 there were an average of 325 men engaged in the various services of the department. Street cleaning, refuse collection and allied services employed 244 men; sewer cleaning, 41 men; maintenance, 19 men, and administration, 21 men.

Refuse Collection.—The collection of ashes and rubbish is the most important function performed by the department of waste collection, both from the standpoint of money expended and from the viewpoint of the citizens. The people will tolerate dirty streets, at least for a short time, but if their rubbish is not removed regularly and in accordance with a fixed schedule, they do not hesitate to complain of the service.

Expenditures for this function made up about 37 per cent of the total expenses of the department in 1928.

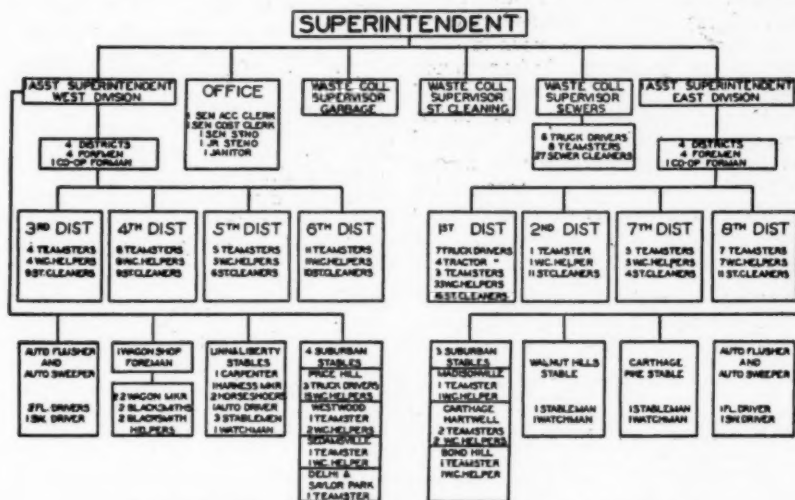
Ash and Rubbish Removal by Wagons, Trucks and Trailers

Year	Cu. Yd. Removed	Expenditure
1924	256,766	\$191,181.39
1925	266,096	203,160.98
1926	299,299	248,774.77
1927	320,127	260,864.00
1928	345,580	284,731.31

Equipment Motorized.—In the past year progress has been made towards the motorization of the equipment used in the removal of ashes and rubbish. An additional trailer unit was installed

ing is being concentrated in a few major places, most of them being on city property, the filling of which will enhance the property value to the advantage of the city.

Containers.—A great improvement has been made in the past year in regard to the use of proper containers. Householders are being reminded that an ordinance requires all trash be placed in metal cans with tight-fitting lids. A great variety of containers are taken



Organization of the Department of Waste Collection of Cincinnati, O.

in the eastern part of the city in June, 1928. Two trailer units are now in operation. Each unit consists of eight trailers, one large truck tractor, and two small tractors. Both horses and tractors were tried at the time the first trailer unit was installed in 1927, and while horses were satisfactory on level stretches, tractors operated more satisfactorily on hills. An electric tractor used in conjunction with the trailers is being experimented with and is proving satisfactory.

The most notable improvement, in the service rendered in the territory covered by the trailers, is the collection of ashes and rubbish from the rear door, instead of from the property line. Not only has the service been improved by the use of the trailer units, but costs have been lowered. Unit costs for 1928 show \$0.739 per cubic yard against \$0.813 per cubic yard for 1927, a decrease of 9 per cent.

Six large trucks are in operation and make collections in the outlying residential sections of the city. By the use of trucks and trailer units the so-called residential dumps have been abandoned, resulting in greater comfort and peace of mind to householders living in the neighborhood of these dumps. Dump-

ing is being concentrated in a few major places, most of them being on city property, the filling of which will enhance the property value to the advantage of the city.

Street Cleaning.—In keeping the streets clean the concern of this Department should be to remove dirt caused by the wear of paving, tires, vehicles, dust from the air, animal excretion, leaves and trash brought in from surrounding territory. In addition, it is necessary to remove sidewalk sweepings, refuse thrown from buildings, articles discarded by pedestrians, construction debris, and trash dropped from overloaded vehicles.

The latter class of street litter can be reduced by the proper co-operation of other municipal departments and by more thoughtfulness on the part of the citizens. In the past year, the co-operation of the police and health departments has been forthcoming in enforcing ordinances that place restrictions on avoidable littering of the streets and

in a large measure, support has been given by civic organizations and the citizens as a whole. However, the need of the interest and wholehearted co-operation of the entire public can not be too greatly stressed in order that the avoidable street litter be reduced to a minimum.

The general use of street waste paper cans is a great aid in reducing the street cleaning operations. During the past year 200 new waste cans were placed on street corners and 156 of the old Bulletin type of cans were repainted and placed at busy corners. There are now 706 trash cans on the streets.

The actual street cleaning operations are closely bound up with the ash and rubbish collection, though the costs are separated. All streets in the down town business area are cleaned at least once a day. Most of the work is done early in the morning, before much traffic is on the streets, by squads of men having certain areas to cover. Patrolmen are maintained on some of the most important streets who sweep up refuse and collect it in cans which they wheel around. Other districts are cleaned once or twice weekly by men who work in gangs.

Every year more streets are being cleaned and cleaned oftener, as is shown in the following tables:

Year	Street and Alley Sweeping Squares Cleaned	Total
1924	97,928	\$36,505.44
1925	122,688	52,948.76
1926	152,935	63,288.09
1927	218,743	75,135.66
1928	263,712	75,909.72

These street cleaning operations are greatly aided by the use of motor apparatus, though on account of traffic conditions it can only be used to advantage at night. Except in cold weather, power flushers are used on improved streets and the main highways. The business section of the city is flushed every night and the main highways are flushed once or twice a week. Four flushers were in operation last year, and 135,796 squares were flushed at a cost of \$8,602.73. A horse-drawn flusher is used in the alleys in the business district.

Two machine sweepers also operated in the summer time. These machines will do from eight to ten times the work of hand sweeping. Last year these machines cleaned 19,152 squares at a cost of \$3,380.55.

Efficiency Man Increases Production

When the driver of truck No. 6 is slow between plant and mixer and the mixer waits 90 seconds for the batch he is delivering, that delay is easily forgotten at the end of the day in a search for the cause of a short day's production. The hose that comes loose and means a brief shutdown is not a

very frequent offender and its role in the decreased production doesn't seem of much importance when the checkup is made each night. But the slow truck, the loose hose, the bit of high grade, and the endless list of other little matters, none of great consequence taken by itself, make up a total that may mean the difference between 1,000 ft. and 1,200 ft. of pavement placed in a day's run. How one contractor keeps a check on delays is told in the Central Construction, as follows:

Booth & Olson, Inc., of Sioux City, during the course of paving operations in Boone County, Iowa, have developed a simple but extremely effective check on such delays. They have hired a young man, wide awake and observant, whose sole duty is to stand at the mixer with a note book and a watch and record what he sees. His entries start at 6 a.m. o'clock and his second entry in his note book is at 6:01 a.m. If a truck is slow he notes that truck number, the exact hour and minute of the day and the length of time the mixer waited for its load. If the hose becomes disconnected he records the time of the enforced shutdown. If a high spot in the grade halts the forward movement of the mixer, that appears in the book. The summation of the minutes and fractions of minutes at the end of the day makes instantly available the total of time lost and the explanation of that loss, and the record accounts for any shortage in the day's production.

The effect of this observation is not only this knowledge of delay causes, however. It actually results in elimination of many possible delays which would transpire without use of the system. The observer, accustoming himself to the measurement of short periods of time by frequently looking at his watch, noticed that the mixing cycle of the mixer seemed unnecessarily long. He timed it and his checking resulted in discovery of an easily remedied defect in the bell-signal on the mixer which was permitting each batch to be mixed 10 seconds longer than necessary. Men at the mixer do not regard the checker with an unfriendly eye. They consider him in the position of one of their own number, as anxious as any other member of the crew to turn out as large a day's production as possible. They have become keener themselves in watching for causes of delay. They are more than usually eager to hasten the repair of breaks and to resume operations after a shutdown, and they take pride in the fact that the time check-sheet at night does not attribute any delays to their own part of the operation.

On a construction project where seconds count as they count on paving, a very considerable saving can be effected, through the slight expenditure required for placing such an observer on the job.

Street Sanitation at St. Paul, Minn.

The city of St. Paul, Minn., has 227 miles of paved streets, 17 miles of paved alleys and 425 miles of streets graded only. The sanitary service on these streets in 1928 is outlined as follows in the last annual report of John H. McDonald, Commissioner of Public Works:

The paved areas—streets, bridges and alleys—amount to 5,227,562 sq. yd. Of this, 61 miles, or an area of 1,433,000 sq. yd., are cleaned by hand sweeping under the patrol system. The districts for each sweeper vary from 3,200 sq. yd. in the business district to 17,000 sq. yd. in the residential sections.

Snow removal, including sanding of walks and steps, amounted to \$40,671; of this the street railway company paid as their portion \$4,421.

In addition to the sweeping service, all paved streets are cleaned with water periodically. This is done with horse-drawn and auto flushers. In the commercial district 7,353 miles of streets are flushed every night. In the outlying district flushing is done as required, 18,366 miles being flushed twice a week and 155,905 miles being flushed once a week.

Where dust was laid by flushing the following rates were used:

	Per Frontage Ft.
Night flushing, daily	\$0.14
Flushing twice a week	.05
Flushing once a week	.025

Water sprinkling on all dirt streets was discontinued on Aug. 18. This was necessitated by the increased cost of this service due to the vast amount of idle travel of teams in sections where sprinkled streets are few and widely separated toward the end of the season. The rate for water sprinkling four trips per day from May 9 to Aug. 18 was 7.15 ct. per frontage foot or \$2.86 for a 40-ft. lot. If water sprinkling service had been continued to the end of the season and the total cost assessed, the rate for four trips per day would have been 26.25 ct. per frontage foot or \$10.50 for a 40-ft. lot.

Two hundred and seventy-one miles of streets were treated with oil, distributed by Kenney auto oilers using 815,200 gal. of road oil. The rate for oiling, two oilings per season, an average width of 24 ft., was 5.76 ct. per foot, or \$2.30 per 40-ft. lot. This class of service has increased on the average of 15 miles per year for the past five years, which indicates a marked preference for this service over that of the costlier water sprinkling.

Sixty-five thousand one hundred and fifty-nine lots or parcels were assessed for sprinkling and oiling. Some of the lots were assessed for both, making a total of 91,892 separate assessments. The decrease in the number of separate assessments is due to the reduction in the number of sprinkling routes.

A Plan for Speeding Traffic Flow

Los Angeles Plan Provides for Widening Street Intersections for Setting Back Curb and Property Lines Giving Extra Visibility and Increasing the Number of Traffic Lanes

A PLAN for relieving traffic congestion on the streets of Los Angeles, Calif., evolved by Thomas Coombs, City Planning Engineer, provides for the increased width of the street at the intersection and for a short distance approaching the intersection and for widening the corner itself.

The Advantages.—The advantages claimed for the plan are:

The rounded corners would permit cars to turn without sweeping to the

section of a major artery with a local street, both conditions are shown, square corners and rounded corners. In dotted lines the result of cutting back the property lines are shown. Visibility is increased approximately 90 ft. when cars reach the property lines of the major artery and stop before turning or crossing.

This advantage of extra visibility and resultant safety is far overshadowed by the ease in which cars can

lanes of traffic and assuming the maximum flow without interruption to be 2,400 cars per lane per hour, we can pass 14,400 cars per hour; and over two such streets 28,800 cars per hour. Where these streets intersect we are constricting two streets into the width of one, therefore the maximum efficiency we could hope to secure at this intersection would be 50 per cent, providing we could eliminate all interruptions. With stop and go signals it takes

PLATE No 1
SCALE 1"=30'

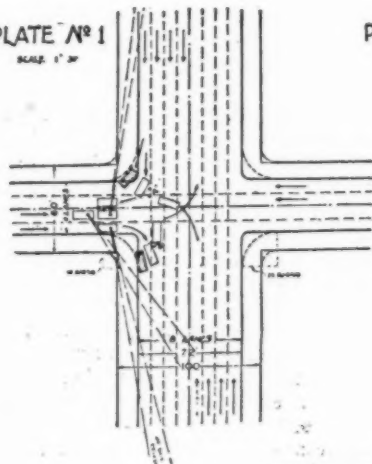


PLATE No 2
SCALE 1"=30'

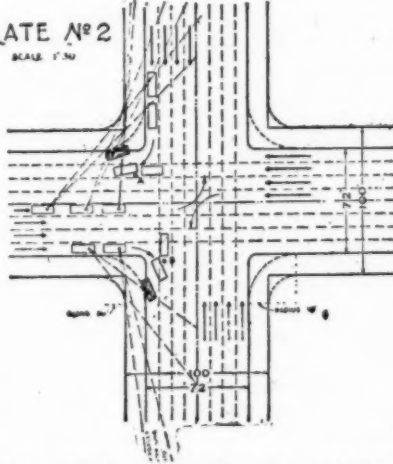
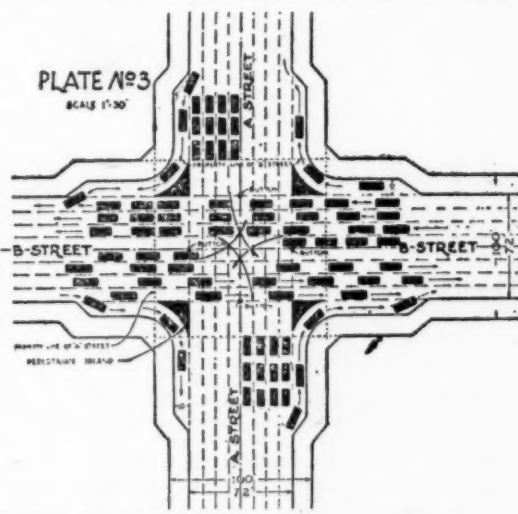


PLATE No 3
SCALE 1"=30'



Plan for Widening Streets at Intersections So as the Traffic Flow Can Be Increased

middle of the street because of having to clear the curb.

The widening of the approach would provide a set-back of the curb and property lines about 10 ft., providing an extra lane near the corner for the distance that is now kept clear of parked cars by the red zones. This space would be utilized to allow continuous right turns.

Widening of the intersection provides extra lanes for traffic. Two center lines, one for each direction, are provided exclusively to accommodate traffic turning left. Cars in these lines would drive to the entrance of the intersection and during the change of signals would make the turn before through cars would be in motion. Four lanes would care for cars proceeding straight ahead. The curb lanes would be for the continuous right turns.

The greatest economy and feasibility of the plan is that the relief would be applied where the congestion is caused, at the intersection, thus saving the cost of widening throughout the block. According to the plan the intersection must be approximately double the width of the main street if that street is to reach its full efficiency.

Extra Visibility Secured.—Referring to Fig. 1, which pictures an inter-

turn right. Automobiles ordinarily require a minimum of 25 ft. radii in turning. Traffic regulations require that a car turning right should be in the outside, or curb lane, before turning. Parking of cars is prohibited within a certain distance of the corner. Therefore the curbs could be cut back to prevent collisions with cars one lane removed from the curb. The effect of cutting property lines on a 10-ft. radii and the curbs on a 25-ft. radii is shown, which makes it possible for cars to hug the curbs in turning right.

Fig. 2 shows the intersection of two major arteries. In this sketch the advantage of visibility is again seen. A continuous right-hand turn could be permitted. If corners are not cut back two lanes will be required in turning right, which will materially retard the flow of traffic in two lanes on each street.

Left-hand turns are responsible for the most of the confusion at intersections. As shown on this plate two lanes are given over to left-hand turns. Left turns require approximately double the time it takes the straight through traffic. This is sufficient reason to segregate left turns.

Would Give Six Traffic Lanes.—On a 100-ft. boulevard we have six moving

five seconds to clear and five seconds to fill the intersection. Twenty seconds are lost in each cycle.

The mechanics of the intersection in Fig. 3 is as follows: Traffic is flowing east and west on "B" street and traffic on "A" street has come to a stop at the property lines. We find cars wishing to turn left into "A" street from "B" street have stopped in the two center lanes and the first cars are opposite the buttons with wheels set for the turn. The red light flashes on "B" street to clear the intersection and as the cars in the center lane make the left turn into "A" street all other traffic on "B" street stops at the property lines of "A" street. Left turns continue until the green light flashes on "A" street.

Control by Lights.—Cars in the center lanes on "B" street not within the intersection stop and the movement on "A" street takes place. Cars on "A" street in the two center lanes pull up to the buttons and stop, ready for left turn into "B" street. When the red light flashes on "A" street through traffic stops at the property lines of "B" street and left turns are made into "B" street. The movement continues until the green light flashes on "B" street and cars not in the intersection

stop at the property lines of "B" street. At this signal through traffic is again in motion on "B" street and cars on "B" street wishing to turn left pull up to the button. This completes the cycle.

The outside lanes are given over to continuous right turns and placing islands at the corner compels traffic in these lanes to turn right and afford safety zones for the pedestrians.

As shown on Fig. 3 a continuous right-hand turn will be possible until at least four cars are in the second lane from the curb waiting for the go signal. This would seldom occur when the intersection is operating on a 60-second cycle. In the ordinary intersection one car can interrupt the right turns at one corner. It is assumed that in segregating the left turns the possibility of accidents will be reduced and we will be able to maintain a steadier flow in all directions.

Trend in Steel Bridge Design

Continuous Bridge Types and New Steel-Plate Floor

By F. H. FRANKLAND

Director of Engineering Service, American Institute of Steel Construction

THE successful design of a bridge requires knowledge of the materials to be employed, the function the structure has to perform, and the forces it has to resist. However, rarely are all of these basic data completely known, and therefore the design must be based on approximations derived from tests and calculations and then checked by the results of experience.

Truly economic comparisons of arch, truss, cantilever and suspension bridges have of late years frequently upset the preconceived notions of some bridge designers as to the relative economy of the various types for various span lengths and class of service. In studying the relative economy of bridge types as applied to a particular problem, consideration must be given to improvements made from time to time in the materials from which to choose, as well as in shop fabrication and erection methods.

Bridge Types.—There is beginning to be a general recognition of the possibilities of continuity in bridge design. Of several recently constructed continuous bridges may be mentioned the Springfield bridge, built recently for the Oregon State Highway Commission; the Lake Champlain Interstate bridge, just completed for the states of New York and Vermont, and consisting of a through arched-truss center span of 434 ft.; a continuous deck-beam bridge recently built for and designed by the Tennessee State Highway Department.

Continuous truss spans are particularly well adapted to cantilever erection, as their lighter members are subject to stress reversal, and will therefore rarely require strengthening to resist erection stresses. The U. S. Bureau of Public Roads has just completed a design for a continuous deck-beam highway bridge in the Zion National Park in southern Utah, wherein the beams are spliced for continuous action; the central span is 88 ft., and there are two end spans of about 48 ft. each. The present-day attitude of designers towards continuous bridges has recently been affected by a more thorough understanding on their part of the structural relations of initial adjustment, the effect of settlement and the uncertainty of analysis, and by increased constructive skill. The type has now quite generally come to be accepted as the full equivalent of other types where field erection conditions and economy in material permit.

Steel construction for many years has leaned toward the statically determined type of structure, but from necessity concrete construction was developed along the lines of constrained forms. The wider use of graphic-stress analysis instead of algebraic calculation has helped to popularize the continuous bridge type, for the obvious reason that the movements at support are furnished by a graphic eye-picture which is self-checking.

New Steel-Plate Floor.—The new steel-plate floor, developed by the American Institute of Steel Construction, and known as the "Battledeck Floor," finds a wide use in the economic design of highway bridges. By this system steel plates are welded to the stringers over their webs and their end edges over the transverse floor beams, so that the plate deck is truly continuous in both directions, the stringers and steel plate thus forming a T-beam, with the neutral axis of the combined section close up under the top flanges of the stringer beams.

A bridge recently designed by the Alabama State Highway Department shows its application to a particular bridge problem. The stringer spacing is 18 in. and a ½-in. plate will be welded to these over their webs. You will note that the plans call for the plates to be 6 ft. wide in long lengths, spliced with a welded batten plate. As some of these plates would be 70 ft., with an area of 420 sq. ft., individual plates weighing some four tons, it is obvious that they would be too unwieldy to handle in the field, consequently the drawings now have a note on them which permits the fabricator to detail the plates in such lengths as to make their handling economical. By placing the plate end-welds over each transverse floor beam, the maximum weight of plate is kept around 1,000 lb. The highway department's bridge engineers made a series of economic comparisons between this design and others based

on the usual types of construction, with the result that a saving of over \$10,000 was indicated.

Various wearing surfaces may be applied to Battledeck Bridge floor construction—either a non-skid surface plate may be used; asphalt paving block 1½ in. thick, as used in this Alabama bridge; asphalt laid in the usual way directly on the plates and of any required thickness, or wood block laid in asphaltic mastic.

Competitions in Bridge Architectural Design.—The American Institute of Steel Construction has this year inaugurated two competitions in connection with bridge architectural design, whereby it is expected that increased attention will be given this important subject. These competitions were, first, an architectural student's competition for the solution of a specific problem of bridge design, for which prizes of \$500, \$250 and \$100 were given. By this means the Institute hoped to stimulate interest and thought amongst architectural students on a subject which otherwise would probably have never come before them. This year there were 57 entries, from which 10 designs were selected for full development, and these 10 were then passed upon by a jury of leading architects to choose the first three worthy of the awards. Next year the Institute proposes to enlarge this competition to include engineering as well as architectural students, as it is felt there is a pressing need to bring about a better meeting of minds as to the appearance of structures among those connected with bridge design.

The other competition is an annual award of merit for the most artistic steel bridge completed during the year. The first award has been made applying to bridges completed in 1928. A jury of award, consisting of two engineers nominated by the American Society of Civil Engineers; two architects, nominated by the American Institute of Architects; and one member, nominated by the American Institute of Steel Construction, the latter being neither an engineer nor an architect, but one who was either an artist, sculptor or layman who has given sufficient attention to the artistic treatment of structures to command public respect for his views on such matters. The award consists of a bronze plaque for affixing to the winning bridge, on which the names of the owners, engineer, architect, fabricator and general contractor are shown; those mentioned individually receive small reproductions of the plaques suitable for desk use.

It is hoped that by such means the architecture of steel bridges may be constantly improved and made a subject of pride to all those concerned with the design and construction of bridges.

Acknowledgment.—The above is an abstract of a paper presented Sept. 17 at the 16th annual convention of the Canadian Good Roads Association.

Up-to-Date Concrete Street Pavement

A Summary of the Recent Developments in the Design and the Construction of Concrete Pavements in Various Cities of the United States

By E. K. SMITH

Of the Portland Cement Association, Chicago

CITIES are building over 50,000,000 sq. yd. of concrete street pavement in the United States each year. This is the equivalent of 20,833 city blocks, each paved 36 ft. wide by 600 ft. long, or six blocks of concrete street paving laid each year in every city of 2,500 people or more.

These include park drives and boulevards, residence streets, business centers, warehouse districts and the busiest through traffic streets, with and without car lines, from Bellevue Ave., the home of the millionaires in Providence, and La Salle St. in the heart of Chicago's "Loop," to Harbor Truck Blvd. in Los Angeles.

Concrete street construction has not been as well standardized as highway building under the stabilizing influence of the Bureau of Public Roads, nevertheless the first concrete street pavements in this country, over 36 years old, are still giving good service. Naturally, experience and research during 36 years have modified pavement construction today.

Subgrade preparation and drainage will not be discussed except to point out that a true surface is now secured by adequate subgrading methods and careful checking with subgrade templates to insure full thickness and true section of pavement.

Materials and Tests.—It is generally recognized that only clean aggregate should be used in a concrete pavement. This usually requires that stone and sand be washed. Occasionally a harsh working mix is caused by removal of too much fine sand and this must be replaced. Cities are today paying more attention to the soundness of aggregates. Organic matter in the sand, shale, flint or unsound particles in the coarse aggregate, must be determined in advance. The tests for soundness are simple and easily applied in the city testing laboratory. In New Hampshire the state highway department gives assistance to cities without a laboratory of their own. In Rochester, N. Y., the city laboratory tests and approves aggregates to be used by contractors. H. W. Hughes is in charge of the Department of Tests. The laboratory then determines the exact mix to be used to give dense concrete of the class and strength desired for concrete pavements. The approximate pavement mix is specified as 1:2:3. The

actual mix for the materials to be used may be 1:2.1:3.2. This has resulted in more uniform concrete of the quality desired and in greater economy to the contractor. In cities where the local aggregates are not considered satisfactory for surface wear, a two course pavement may be built. In Erie County in western New York, for example, a top course of concrete using gravel up to ½ in. is used.

Proportioning Aggregates by Weight.

—In up-to-date street construction aggregates are proportioned by weight, not by volume. It is just as simple as batching by volume, and allows much more accurate control. It practically eliminates the effect of bulking of sand from moisture content.

Central Mixing Plants.—Central mixing plants are gaining in favor for modern construction. They eliminate the necessity for frequent change in location of storage piles and delays while a paving mixer is slowly traveling from one street to another. Palo Alto and Los Angeles, Calif.; Portland, Ore.; Kansas City; Washington, D. C., and Rochester and Albany, N. Y., are some of the cities this year using centrally mixed concrete on paving work. Some type of agitator body is usually employed in delivering the mixed concrete. Reports from all of these cities indicate satisfaction. It is easier and cheaper to handle and control water and aggregates at the central plant and more uniformly strong concrete is delivered on the street.

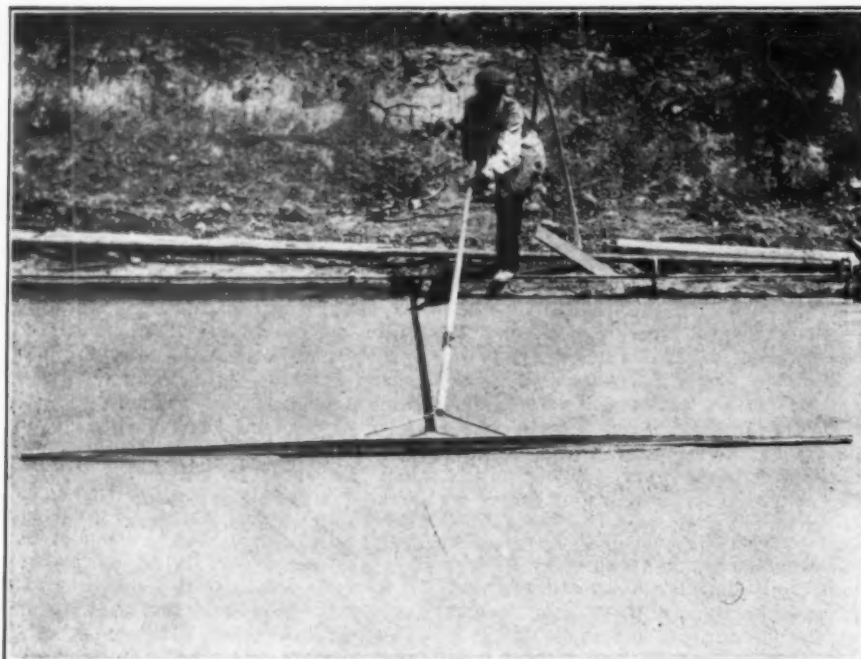
Careful Water Limitation.—Every year more cities are designing their pavement and base mixes to develop the definite strengths desired and carefully regulating the amount of water in the mix. Of course, other factors may affect the strength of the concrete, but it is unquestionable that for a workable paving mix using known aggregates, the strength varies with the amount of water. The simple apparatus for determining the moisture content of sand and stone may be installed in a back room of the engineer's office if not convenient to do this on the job. This test is made once or twice a day or more often. The total gallons of water per sack of cement (usually 5½) is specified in accordance with the strengths desired. Water already in the aggregates is deducted to determine the amount of water added to

each batch. Mixer manufacturers can now supply accurate water measuring tanks and one of the first duties of the inspector is to see that the gauge correctly indicates the amount of water discharged and that no more than the required amount can be turned into one batch. Even cities not yet specifying the water in gallons per bag of cement, maintain dry concrete by use of the slump test. Sloppy batches produce poor concrete.

Forms.—Substantial forms staked solidly in place and set truly to line and grade are the first assurance of true surface and smooth riding pavements. The long heavy strike off or the finishing machine, bring a considerable strain upon the forms. Steel forms are today built with a base as wide as 6 in. Rain or water from the concrete often softens the subgrade under the forms and even a slight shifting of the form will cause a wavy pavement surface.

Surface Finishing.—Up-to-date construction requires the least possible amount of "finishing." We all know how too much "finishing" can bring to the surface an excess of fine material and laitance that will separate readily from the slab below. Perhaps the most important effect of over-finishing is working excess water into the surface concrete, and thereby weakening it. With the relatively dry concrete used today, good practice calls for a heavy strike off, weighing 20 to 30 lb. per foot, followed by a lighter one, each pushing a ridge of material before it, and one belting. Hand floats and "lutes" are used to correct irregularities and where the crown is too irregular to use the strike off. Scraping the surface with a light straight-edge is recommended to remove any excess of fine material and water, followed by a final belting. A burlap belt is sometimes used to remove this surface film. Where a particularly "non-skid" surface is desired, as on grades, a coarse broom drawn once over the surface leaves a coarse, gritty texture, yet smooth riding.

The Finishing Machine.—Finishing machines are coming into greater use on street paving. The advantages are the use of a stiffer concrete, greater speed and economy and more uniformity in the slab. Sometimes the machine operates on side forms, while the curbs



Longitudinal Float Used at Kirkwood, Mo., in 1929

are cast in place later. Sometimes combined curb and gutter are placed first and the machine rides the edges of the gutter slabs or on a center form if the street is wide. Hand finishing is used at the intersections, at least until a finishing machine is devised especially for this work, but machine finishing is suited to a considerable amount of street work, where curb grades do not vary greatly and the crown is uniform. Plane surfaces instead of curved crowns make the use of the machine still easier. The machine is especially suited for paving wide streets where the concrete is laid in strips 10 or 20 ft. wide.

Tests of Concrete.—Speed limits are increasing on through streets, arteries and boulevards, and rough riding pavements are always objectionable. Few cities today neglect to use the 10-ft. straight-edge to check surface smoothness of concrete pavement. Up-to-date construction uses a metal cap for pre-moulded joints or a filler for poured joints, that does not project above the surface, so that finishing may be carried straight across it.

The strength of the concrete is checked continually during construction. From the concrete deposited on the street, the inspector casts at least two 6x12-in. cylinders for each block of pavement. If practicable these are cured in the ground in the same manner as the pavement, then are capped and broken damp in the city laboratory or a commercial testing laboratory, usually at 7, 14 and 28 days. The City of Los Angeles regularly records 28 days strengths of over 4,000 lb. per square inch with standard pavement.

Some cities now break beams 6x6x30 in. to determine the transverse strength of the pavement. Both tests are espe-

cially valuable when pavement must be opened to traffic at the earliest possible moment. Duluth, paving Michigan Ave. with high early strength concrete in 1926 secured 2,100 lb. strength at four days and 2,950 lb. at six days. The street was opened to ordinary traffic in four days. Cores are later cut from the slab, capped and broken as a final check on the thickness and strength. Cores cut from concrete pavements in Chicago last year showed interesting results.

Curing.—Keeping the pavement continuously moist by the application of

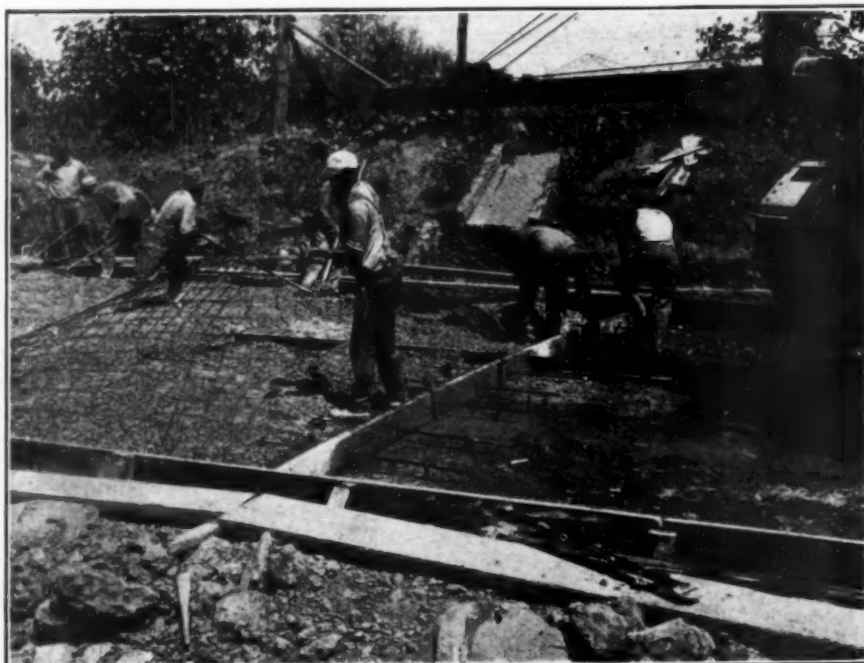
water is still the accepted method of curing. In a few cities "ponding" or continuous spraying are employed. A more common method is covering with wet burlap over night, followed by earth or straw covering kept wet for 14 days. Even where pavement is opened in less than 14 days, additional wetting down at intervals is desirable. Curing by application of a surface coating of some material is in vogue in some cities.

Joints.—Good practice today calls for separating concrete street pavement into slabs about 10 ft. by 30 or 40 ft. by means of expansion and contraction joints. All joints should be edged at the surface, straight, and truly vertical. Expansion joints must be entirely filled with the "filler," leaving no room for stone or other incompressible material to work in.

Curb.—Four types of concrete curb are in general and satisfactory use today. Curb may be cast in place either before or after the pavement slab is laid. Curb precast in sections is used in western New York and in the South. Roll face curb formed integrally with the pavement slab is economical to build and presents an attractive appearance. Combined curb and gutter, laid before the balance of the pavement, gives the best control over poor drainage. On bad soil the gutter is dowelled to the pavement slab.

Good construction is better demonstrated than discussed. The following examples show typically good concrete street construction throughout the country:

Ventura, Calif.—A 250,000 sq. yd. paving contract was recently completed in Ventura, Calif., under supervision of D. C. McMillan, City Engineer. All materials were batched by weight at the



Reinforcement, Dowels and Sleeves Used on Kirkwood, Mo., 1929 Paving Work



Burlap Covering and Immediate Sprinklings, Washington, D. C.

central mixing plant installed by the contractors, the Griffith Co., of Los Angeles. Five and a half gallons of water per sack of cement were used with the designed mix of 1:1.34:2.94 to develop a predicted strength of 3,550 lb. per square inch at 28 days; mixing time $1\frac{1}{2}$ minutes. Test cylinders showed 2,500 lb. at seven days and 3,424 lb. at 28 days. Two cylinders were cast daily and cores drilled at the same points at 21 days. The sections used on different streets were 11-8-11-in., 8-6-8-1/2-in. and 7-in. uniform. The maximum width of each panel with thickened edges was 15 ft.

A machine, running upon side forms was used for finishing, followed by a longitudinal float and a belt. Premoulded joint filler was used at transverse expansion joints 50 ft. apart and along longitudinal thickened edge joints. "Dummy joints," 2 in. deep were placed at the 25-ft. intervals between expansion joints. This pavement was cured by the Hunt Process.

Kirkwood, Mo.—The new pavement on Essex Ave. in Kirkwood, Mo., was completed in August. Here again proportioning by weight was required for the 1:2:3-1/2 mix. Water, including all free water in the aggregates, was held at 6-1/2 gal. per sack of cement. Central mixing and machine finishing were allowed by the specification but the Carlon Construction Co., the contractors, brought a mixer on the job as usually and finished by hand. Time of mix was held at one minute.

A slump of 3/4 in. to 2 in. was called for. This rather dry concrete required a considerable hand finishing and would have been well adapted for machine finish. The slab was 24 ft. wide with deformed metal center joint. The con-

crete was struck off and tamped three times with a strike-off weighing not less than 15 lb. per lineal foot. Final finishing was obtained with a 10-ft. longitudinal float, followed by belting. Some surface water was removed with the 10-ft. aluminum straight-edge.

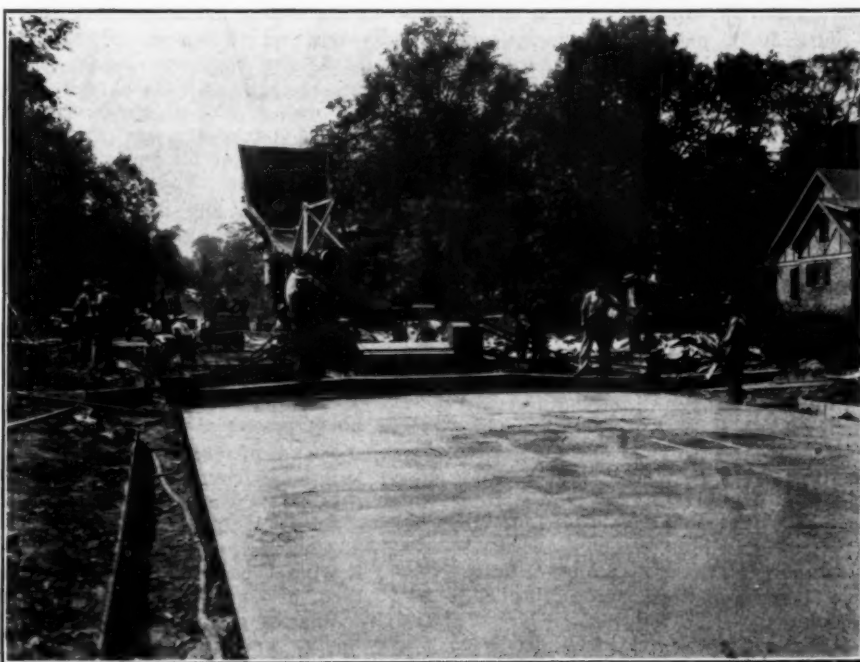
Forty-two pound wire mesh reinforcement was used. One inch premoulded expansion joints were spaced 90 ft. apart with "planes of weakness" at 30-ft. intervals. Expansion material was left 1/2 in. below the surface of the pavement and supported by a header shaped to the crown of the pavement so that it did not obstruct finishing.

After removal of the header the 1/2 in. of concrete was cut out and the joint edged, and later poured with asphalt. The "weakened plane" joints for contraction were formed like the "dummy joints" of the west coast states by driving a tee-iron into the surface of the concrete to form a wedge-shaped groove 1/2 in. wide at the top and 2 in. deep. These joints were also edged, and poured with asphalt.

Three-eighth-inch by 5-ft. tie bars were placed across the center joint 4 ft. apart. Three-quarter-inch by 4-ft. dowels on 2-ft. center, with one end greased, free to move, were placed across all transverse joints. At expansion joints only, a metal sleeve was placed on the greased end of the dowel to provide room for thrust.

In building the integral curb a face plate was clamped to the back form to permit tamping concrete in the curb. In a few minutes this was removed and the curb shaped and smoothed by the finisher. Features of this job were the substantial supports for the forms; the care taken to have expansion joints fully open, straight, vertical and at right angles to the forms; also the use of pins to hold dowels and tie bars in their proper place. The specifications called for burlap and wet earth curing but allowed surface application as an alternate. William Berry was the engineer. Clayton Blvd., 66 ft. wide, entering St. Louis from the west, was of similar construction, built during 1928 and 1929.

A finishing machine was used on street jobs in Indianapolis by the Indiana Asphalt Paving Co. this year with good results. Straight face concrete curb was first cast in place along the street. Steel forms were placed 2 to 3 ft. out from the curb on which the



Finishing Machine on 1929 Street Work in Indianapolis, Ind.

finishing machine was operated. The narrow strip next the curb was finished later by hand and the depth of gutter adjusted for drainage. This outer strip was keyed to the main slab with a tongue and groove joint. Deformed plate was used for center joint.

Work in Other Cities.—A last year's job in Oldtown, Me., illustrates care in placing double bar mat reinforcement. The contractor, John Webster of Bangor, Me., supported each joint on a small cube of concrete which was cast into the slab. This job also illustrates an especially coarse broomed surface on a steep grade, secured by tying the tufts of fibre together.

Albany, N. Y., each year lays a heavy yardage of excellent concrete pavement. This season's work included 7-in. concrete pavement with 120-lb. bar mat reinforcement through Washington Park. This was struck off once with a heavy, 4-man screed, made of a steel channel, and followed by a lighter 2-man screed. Hand floats, both long and short handled, were used on irregularities in the surface, and the pavement belted with a board belt. Final belting with a canvas belt was followed by brooming.

Excellent pavement was obtained with the minimum of work in finishing. On this job excess water or mortar was removed before the final brooming with a burlap belt. A special hoe or "spud" was used for spading along the forms. Mr. J. G. Brennan is the city engineer.

A feature of 1929 work in Washington, D. C., has been the use of metal plates expanded with a filler to form the expansion joints. A V-shaped plate formed planes of weakness at contraction joints. Expansion joints are spaced 90 ft. apart and contraction joints marked by grooves cut 3 in. below the top of the pavement at intermediate 30-ft. points. All joints are later poured with bituminous filler. Another feature on the Washington work is the use of adjustable steel forms for casting the concrete curb in place along the slab.

Further examples of recent construction are Third Ave., in Seattle, repaved with concrete this year; LaSalle St. in Chicago's "Loop"; Riverside Drive, 70 ft. wide, Los Angeles, Calif.; City Line Road in Philadelphia, Pine St. in New Orleans. New Orleans pavements are built under the supervision of John Klorer, Commissioner of Public Works, and Bryan Vallas, City Engineer. A feature of their 1929 work is the curing by continuous sprinkling systems. New Scotland Ave. in Albany, and Wisconsin Ave. in Washington, D. C., completed this year, have 8-in. concrete, 60 ft. wide, including double car track.

Summary.—The main points of up-to-date concrete street construction may be summarized as follows:

Substantial forms carefully set.

A designed mix with materials proportioned by weight.

Accurate limitation of total water to a specified number of gallons per sack of cement.

Steadily increasing use of central mixing plants and machine finishing.

The least amount of finishing required to bring the concrete to a true contour and dense hard surface.

Thorough curing to develop the full strength of the concrete, especially important during the first few days.

Tests to determine that the desired strength, smooth surface and thickness have actually been obtained.

The results, in the cities mentioned, and many others, are street pavements of uniformly high quality and greater economy for the contractor and the city.

Acknowledgment.—The above paper was presented Oct. 17 at 35th annual convention of the American Society for Municipal Improvements.

Counties Are Building Higher Type Highways

Reports obtained by the Bureau of Public Roads, U. S. Department of Agriculture, from authorities of selected counties indicate a tendency toward a higher type of local and county road construction in the United States. With each succeeding year the percentage of graded and drained earth roads decreases and the percentage of surfaced roads increases, says the bureau, on the basis of the reports.

The reports indicate that there was improved in 1928 in the entire United States, exclusive of state roads, a total of 45,531 miles of local and county roads, of which 29,888 or 66 per cent were surfaced, and 15,643 or 34 per cent were graded and drained earth roads. In 1927, the estimated mileage improved was 59,732 miles, of which 33,852 or 57 per cent was surfaced and 25,880 miles or 43 per cent was graded and drained. In 1926, the total mileage improved was 89,026, of which 36,027 miles, or 41 per cent, was surfaced, and 52,999 miles, or 59 per cent, was graded and drained.

The surfaced roads constructed in 1928, indicated at 29,888 miles, are made up of the following types of pavement: Sand-clay and topsoil, 3,518 miles; gravel, 20,221; water-bound macadam, 3,001; bituminous macadam, 1,631; sheet asphalt, 83; bituminous concrete, 267; Portland cement concrete, 1,145; and 22 miles of brick and other block pavements.

At the end of 1928 the estimated total length of county road systems was 2,709,839 miles, according to the figures given to the bureau. Of this total, 432,999 miles are surfaced, with the following types of pavement: 74,562 miles of sand-clay and topsoil, 277,797 miles of gravel, 46,454 miles of water-bound macadam, 14,953 miles of bituminous macadam, 1,472 miles of sheet asphalt, 3,763 miles of bituminous

concrete, 12,317 miles of Portland cement concrete, and 1,681 miles of brick and other block pavements.

The reports from the selected counties indicate a total expenditure for the entire United States in 1928 of \$282,314,715 for county and local road and bridge construction, \$259,753,188 for maintenance, \$79,806,915 for interest on bonds and outstanding notes, and \$37,347,326 for miscellaneous expense. They all indicate that the counties paid out \$103,281,707 in retirement of the principal of outstanding bonds and notes, and transferred \$69,638,156 to the states for work on state roads, making a grand total disbursement of \$832,142,007 and leaving an unexpended balance of \$176,082,089 for all counties in all States.

At the beginning of 1928, the reports indicate, the counties had an estimated total of \$1,008,224,096 available funds for local road and bridge construction, this consisting of an unexpended balance of \$172,897,145 carried over from the previous year and a total income of \$835,326,951. Of the total income, motor vehicle license fees and gasoline tax receipts, \$50,322,055 and \$53,778,852 respectively, contribute 12 per cent, receipts from local bond sales of \$150,222,357 represent nearly 18 per cent, and the local road tax of \$416,812,566 is 49 per cent. Of the total estimated income for 1927 of \$840,613,923, motor vehicle license fees and gasoline tax receipts, \$40,239,856 and \$46,860,509 respectively, represented 10 per cent, sales of bonds (\$181,080,953) 21½ per cent, and local road taxes (\$405,219,774) 48 per cent. In 1926, motor vehicle license fees and gasoline tax receipts, \$37,861,018 and \$39,733,227 respectively, contributed 10 per cent of the total income of \$775,423,632, sales of local bonds (\$168,575,423) more than 21½ per cent, and local road taxes (\$357,263,356) 46 per cent.

Making Highway Storage Sheds Attractive

Trees, shrubs, flowers, and grasses have been planted about highway storage sheds of the Pennsylvania Highway Department and highway superintendents are directing a general clean-up of their shed grounds. This is in line with the department's policy of improving the appearance of storage sheds for the effect upon the morale of employees who work at these locations, and to make the appearance of the properties a credit to the department and to the state. More than a hundred storage sheds are used by the department. Lawns, hedges, screens, rambling roses, perennial flowers, window boxes, shade trees, and groups of shrubbery and evergreen trees have already been planted, replacing the worn-out equipment and oil-covered parking spaces that formerly existed. Planting was directed by John W. Keller, Department Forester.

Constructing Highway Embankment Across Lake

Method of Building a 1,615 Ft. Long Earth Fill Through Mud and Muck in a North Dakota Lake to Replace an Old Wooden Trestle

By A. S. MAREAN

Resident Engineer, State Highway Department of North Dakota

UPPER DES LACS is the name of a body of water which extends across the International Boundary and which is crossed by North Dakota State Highways 5 and 9 near Bowbells. This body of water is a river-like lake and was the scene of an interesting bit of construction work, done under direction of the State Highway Commission of North Dakota. This work is officially known as Federal Aid Project 303-A.

The Old Structure.—A wooden trestle was built during the winter of 1905-1906; also a swing bridge, 125 ft. in length, was installed toward the east bank of the lake to permit passage of tug boats hauling barges of grain down to the main line of the Soo Railway at Kenmare. This was before branch lines had been extended into the territory at the north end of the lake.

Pilings were driven through holes cut in the ice and in some places these were spliced by "butting one on the other and slapping on two by fours." It is a standing joke among some of the early settlers that it was necessary to pull the piling back to grade in many places, owing to the depth of muck on the lake bottom. Nearly every spring the trestle was battered, pushed out of alignment and individual pilings were broken off at the water line or below by drifting ice floes, a mile or more in length and a quarter-mile wide.

Shortly after the close of the World War, it became imperative that some definite plan be made to replace the trestle, select a new site, abandon or

maintain the trestle at great expense or select a new route for the state highway that was to be built. A new route meant that Bowbells, the county seat of Burke County, would be isolated from her township east of Upper Des Lacs lake if the road were to pass around the south end of the lake or if it went north and across; unless a new site could be located near the old trestle. Either route would be roundabout. As the old trestle is on the line between Burke and Ward counties, a new crossing, unless on the county line, would force one county to bear 25 per cent instead of 12½ per cent of the cost of construction. Also a new swing bridge would have to be constructed to comply with War Department regulations, if a new site were used (the lake is navigable waters by an act of Congress); whereas the old swing span could be utilized by using the county line.

During the time prior to 1927, several surveys were made to determine whether better approaches to the present site could be obtained by following the section line or some other route. Soundings of the lake bottom were made through the ice at various places south of the old trestle. It was found that the depth of muck gradually increased toward the south end of the lake. No soundings were made north of the trestle as a crossing in this region would mean doubling back to get into Bowbells.

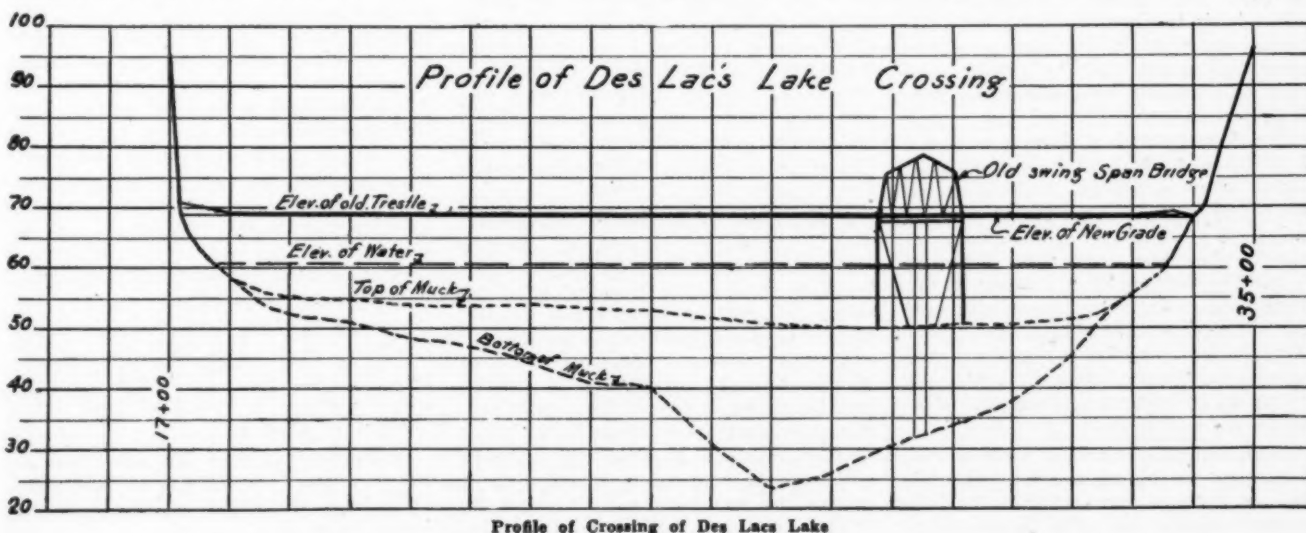
Data having been gathered, the type of construction was discussed. Some engineers favored a bridge, others a dirt fill. If a bridge were used, an

immense amount of excavation from the approaches had to be disposed of in some manner. Also coffer dams, wet excavation and piling for the bridge piers would amount to a considerable sum. Preliminary tests made by hand forcing a rod, showed muck to range up to 26 ft. in depth with 10 ft. of water.

It was decided to use the section line for approaches; make the maximum grade 7 per cent; leave the old swing bridge in place and make a fill across the lake or rather on each side of the swing span. Plans were prepared by the Bridge Department of the State Highway Department. A contract for one mile of work was awarded to Schultz Bros. of Bowbells, North Dakota, at a bid of \$98,361.49.

Embankment.—The embankment across the lake, 1,615 ft. in length, was designed to use 141,644 cu. yd. of excavation; an allowance of 40 per cent being made for shrinkage. The road is to have a 28-ft. top, side slopes of 2 on 1 above the water, 3 on 1 below. Before the project was completed it was decided to raise the embankment 1 ft. and widen the top 3 ft., so that the total yardage of earth required was 167,000 cu. yd.

To protect the side slopes from wave action a brush mattress (modified Missouri river revetment) was laid thereon at equal distances above and below the water line. To secure the mat in place, a system of longitudinal and transverse cables was devised; the transverse cables passing under and over the mat, thence through the embankment to the mat



Profile of Crossing of Des Lacs Lake

on the opposite side. Upon this mattress, stone paving of field rock was laid, 1 ft. thick at the edges and 2 ft. thick at the water line. Cribbing timbers made by spiking old bridge planks together were placed at the lower edge of the mattress, to prevent the paving from slipping and sliding. As an additional precaution, a floating boom of timber in sections of 50 ft. was installed on each side of the fill.

At each end of the 125-ft. swing bridge, it was decided to drive a line of 50-ft. piling, extending out 30 ft. at right angles to the center line. These were held in place by means of a rock fill on one side and the embankment on the other. Immediately back of the piling, a curtain wall and bridge seat of timber were erected and held in place by cables anchored to adjacent bents of the old trestle and by bracing additional bents, one to the other.

Making the Fill.—Before beginning actual construction work, Schultz Bros. had intended to use a narrow gauge railway and dump cars but decided the condition of the old trestle involved too great a risk. It was decided to push the grade out by means of a "bulldozer," on a 10-ton Caterpillar tractor.

Work was commenced April 25, 1927, with considerable frost still in the ground. Wagons were loaded by a $\frac{3}{4}$ -yd. steam shovel and hauled to the dump by Caterpillar tractors. Good progress was made until May 10, when a late blizzard piled the cut nearly full of snow and held up operations one week.

Muck Rises.—When the dump had been pushed out 200 or 250 ft. from the shore line, patches of muck appeared above the lake surface 80 to 100 ft. away on each side. Shortly after this, the muck appeared ahead and around the fill forming a crescent. At this juncture, it was decided to strengthen those old piles at the east end of the swing span to which braces for holding the bridge seat and curtain wall were attached. Accordingly, four $\frac{3}{4}$ -in. cables were fastened to the piles of one bent and anchored to a deadman buried back in the fill. This held for a short time, then the piles snapped below the muck. By this time, the muck had pushed up against the new piling around the end of the swing bridge, but the swing showed no signs of being disturbed or pushed out of place. It was decided to anchor all the piling at the end of the swing bridge to deadmen. Work was resumed; when the dump was within 50 ft. of the bridge, the extreme wing piling went 9 ft. out of place, forward and slightly to one side. The center piling supporting the bridge seat and curtain wall went forward about 1 ft. or enough to prevent opening and closing of the waterway.

At that time there were 1,300 cu. yd. of rock on the opposite side of the piling. In spite of the fact that the lake bottom beneath the muck slopes down-

ward on a 4 per cent grade, the rock had remained above the water level for some time and had shown no indication of settlement. Muck at this point was 14 ft. deep, covered by 10 ft. of water.

Temporary Trestle.—A temporary trestle was built to span the gap between dump and swing span. Excavation was "bulldozed" off the swing span and was given up after two days' trial. Operating tractors, wagons and a bulldozer on a bridge 18 ft. wide was not conducive to progress. The 4-wheel scraper and "old Dobbin" were left to work out this opposition. The outfit was moved over to the west shore by barges.

Operations from West Shore.—On the west side of the lake, the action of the fill on the muck was much the same as on the east, only in a greater degree. At first a quaking, quivering mass of foul smelling dark gumbo appeared, being pushed up slowly but steadily as the fill grew, often being 6 ft. above the water. It hardened and fissured on the surface as time went on. Those courageously inclined could walk over it. Old piling were snapped off below, carried forward like soldiers on parade by this irresistible black mass, finally toppling over to lie prone or disappear into the murky depths.

As a rule, a narrow channel of water remained between the muck and fill but now and then, the mud would pile up and roll back on the dump. The muck directly ahead of the fill was so compact that the 10-ton Caterpillar tractor was run out where there was less than 1 ft. of fill. This was done, not once but several times. These times were exceptional and not the rule. Very little settlement was noticed.

The entire fill had to be raised 1 or 2 ft. every week throughout the season. Some weeks no advance into the lake was made. It kept the outfit busy to hold what they had gained. During the night, longitudinal sections of the fill would crack off in lengths varying up to 100 ft. Settlement ranged from a few inches to 4 ft. Once a section covering 25 or 30 sq. ft. of area along the center line dropped down 3 ft. This was in a part of the grade that had been constructed for some time. Each settlement spread the muck out more and more, the outer edge often being 125 ft. from the side slope.

From Mud to Dust.—A night shift was tried. A few days of dry weather and strong winds made the dust unbearable and dangerous for the "cat skimmers." Grades down which the dirt was hauled varied from 7 to 15 per cent. One stretch was over a coulee where the fill was 30 ft. in height. Sprinkling was resorted to; a light application was time wasted; a heavy application made the roadway slippery and hard to negotiate. Finally, fresh excavation was spread over the roadway bladed off daily and sprinkled

lightly with water. This worked admirably and produced excellent results.

Water and quicksand, where least expected, were encountered in the cut high up on the slope of the hill. At times, with great difficulty, one wagon only could be hauled through this sodden ground. The shovel had to leave this place several times to allow the water to drain off. In some places bluish white rubbery clay predominated. The shovel was taxed to make an advance of 40 ft. during the day while taking out a strip 4 ft. deep and 15 ft. wide.

Rock Fill.—Rock was added periodically throughout the season to the rock fill around the ends of the swing span. The rock was piled up 4 or 5 ft. above the water line. At the east end, the rock would remain stationary for a short time, then settle slowly or disappear overnight. Some signs of settlement were noted during the winter. The center piling supporting the bridge seat and curtain wall have been forced back into place; those on the extreme end of the line have gone back some but probably never will return to their original position.

At the ends of the bridge, a total of 9,000 cu. yd. of rock were placed. No decided settlement has been observed since the middle of October. The rock on the east end of the bridge is on the down hill side of the piling while that on the west end is on the uphill side. Muck is present here as usual, the rock forcing it up. The waterway beneath the east end of the bridge was practically blocked for a time, but finally opened as the muck settled away.

Brush Mattress.—A total of 90,000 sq. ft. of brush mattress was used on the sides of the fill. Diamond willows were shipped from the Missouri River Valley at Williston, N. Dak., by freight and hauled out to the lake by truck. Chokecherry brush used on the underwater portion of the mat was secured in the Mouse River Valley, 20 miles east of Upper Des Lacs lake and hauled overland by truck. The mattress is similar to the revetment used by the War Department on the Missouri river. The mat used on F. A. P. 303-A is thicker and of very close weave or stitch.

For the stone paving to cover the mat, rock was gathered from the shore of the lake and hauled over the ice by horse-drawn sleds. The loads varied from 2 to 7 cu. yd. The rock were laid on edge on the mat, the interstices being chinked with smaller stone.

In weaving, the cherry brush made a thicker mat owing to its numerous small branches. It required more cherry brush to produce the same number of squares.

Acknowledgment.—The foregoing is taken from the September Highway Bulletin of the North Dakota Highway Department.

Reserving "Main Street" for Essential Traffic

Traffic Control Situation as It Relates to Street Storage of Cars

By HAROLD M. GOULD

Consulting Traffic Engineer, Police Department, Detroit, Mich.

THE Alexander Hamilton Institute recently issued a pamphlet in which the following statement appears:

"There has to be some head to every business, and that head must be able to see all sides of the problem."

It is quite immaterial whether the head be an individual or an association of individuals. The thought expressed in this quotation will be accepted by all business men as being basically sound, and they will agree that any other premise would be ruinous as far as their own respective businesses are concerned. Yet as far as the regulation of street traffic is concerned, that thought is almost the last one given consideration by the general public. The sparring for credit, the intolerance toward plans and suggestions made by others, the seeking for publicity, the selfishness, and in some instances, the subterfuge on the part of those old enough to know better, are resulting in nothing except an exhibition of how not to get anything done.

Of all the things that vitally concern everyone, adequate and expeditious transport of persons and goods undoubtedly stands in the front rank, and should be the last thing to be played or tampered with. Unfortunately, this fact seems to have been most thoroughly ignored, both by individuals and associations alike.

Popular Agreement Needed.—One aid to the solution of the traffic problem lies in the realization of the need for and a consequent consummation of a popular agreement to regulate street traffic on the same basis that any privately owned and operated enterprise would do it. In fact, if any other attitude could be made as unattractive as a red hot poker, and only those specially detailed or authorized to direct the traffic regulation be provided with tongs or asbestos gloves, that would be a step in the right direction.

Thousands of dollars have been spent in making traffic surveys throughout the country, and, according to reports, most of this money has been wasted, because the only people who were interested in the putting into effect of the recommendations therein were those who advocated the surveys in the first place, and they were not in a position to force the issue. The making of traffic surveys is a harmless amusement, somewhat like voting the Democratic ticket in an overwhelming Republican section or vice versa. The real test comes in making use of the survey after it has been completed.

Parking in Detroit.—Detroit's experience in that respect with particular

reference to the "poison ivy" of street traffic regulation, viz., the street stored vehicle, may be of interest. A survey of the downtown business district in 1927 showed, during a normal business day 33,342 vehicles parked at the curb. Of these, 26,033 or 78.08 per cent were parked for an hour or less, and used 39.74 per cent of the hourly curb parking spaces; while the balance, 7,309 or 21.92 per cent were street stored for periods in excess of one hour, and in so doing occupied 60.26 per cent of the available spaces. For the vehicles parking for one hour or less, the average time was thirty-three minutes, and for those storing the average time was three hours. It doesn't require much imagination to reach the conclusion that this division of street space was unfair, not only to the abutting owners and tenants, but to the city as a whole. The unfairness is still more apparent when it is shown that there were available at the same time 6000 unused parking spaces in neighboring parking lots and for-hire garages.

These facts were ignored and the matter lay dormant until the spring of this year, when the merchants and property owners came to the conclusion that vehicles stored in the street for the personal convenience of a few people, did not constitute an asset to the community, and the Common Council was petitioned to provide sufficient tow-cars and auto pounds with which to enforce the ordinance. Coincident with this petition, were petitions for enforcement in two other sections of the city, and a request for additional enforcement in a third.

The Common Council appropriated \$50,000 for this trial enforcement, which went into effect August 7.

As might be expected, those motorists who had been ignoring the ordinance, promptly rushed into print with charges of discrimination, a prediction of the ruination of the tourist business, and a demand for the use of discretion on the part of the Police Department.

On the other hand, very little if any effort has been expended by the thousands of motorists who have benefited by the enforcement in giving publicity to their side of the story. The benefit is apparent to anyone taking the trouble to observe the conditions as they exist today. It is now generally possible for the motorist who desires to shop or transact short time business, to find a parking space within reasonable distance. There may be times of course when the demand for hourly spaces may for short periods exceed

the supply, but in general the reduction in the number of street stored vehicles has given the shopper a chance to use what space there is available.

One of the local papers sums up the situation with the statement, "Naturally a motorist whose car is impounded resents being penalized for doing what he did with comparative impunity yesterday, and what he will do again with comparative impunity tomorrow. He shouldn't feel resentful; he should show common sense and avoid the tow-wagons, but human nature is human nature, afoot or awheel."

Preventing Concentration of Traffic.—With the number of vehicles now trying to move along the streets of our cities, "Main Street" must give way to "Main Streets." In other words, the traffic, instead of being allowed to accidentally, deliberately, or for any other reason, concentrate on a few thoroughfares, should be diluted, scattered or spread over as many streets as possible. The greatest drawback to this plan is the parked vehicle.

Detroit has, as well as many other American cities, miles and miles of streets where pavement widths are of the order of 26 to 36 ft. in width. With curb parked vehicles on both sides of such streets, traffic that might use some or all of these streets, is driven to use a comparatively few wide streets.

A simple remedy lies in prohibiting the parking on one side of every street whose pavement width is 36 ft. or less. Several months ago a test was made of applying the principle of staggered parking on one of Detroit's narrow but important thoroughfares (Vernor Highway from Van Dyke to Drexel). In this plan of parking restriction the parking prohibition instead of being applied to one side of the street throughout its length as is done with fire routes, is applied to one side of the street for one block, to the other side of the street in the next block and thus alternated block by block. This trial plan was instituted in three sections, several weeks elapsing between the application and the results checked. It appears that the staggered parking plan, because of its fairness to abutting owners, is almost as self-enforcing as that of a fire route.

What becomes of the vehicles whose parking space is reduced one-half? Some of them park on the side of the street where there are no restrictions. Others find off-street parking space in public and private lots, in back yards and in garages. It also has the effect

of driving off of the street and into parking lots provided by manufacturers, the cars of their employees. The latter will use the street for parking in preference to a parking lot even though the manufacturer has gone to great lengths to provide the off street space. Many of Detroit's manufacturers, Packard Motor Company, Ford, Lincoln, Dodge, Chrysler, Budd, Turnstedt and many others, have assigned as parking space for their employees property valued in the millions. There are many employers however that have done nothing in this respect, probably because the necessity has not become apparent to them.

At least one apartment house owner has recognized the necessity of providing off-street parking space for his tenants, and a garage has been incorporated in the building. Another apartment house owner has provided a parking lot for his tenants.

These self-help methods, if applied on a large scale, would bring immediate beneficial results in the traffic situation.

The return of streets to the purpose for which they were originally intended—that of moving vehicles instead of using them for storage purposes, necessitates a realization that economics rather than personal whims or convenience, should govern.

The foundation for this plan is laid in the suggestions made in the Second National Conference on Street and Highway Safety which called for, first; an official traffic commission composed of certain city officials and second,—a traffic advisory committee "made up of street, railway companies, motor-bus companies, taxicab companies, trucking organizations, chambers of commerce, automobile clubs and associations, safety councils, merchant's associations and other interested groups."

The duties of the former are to coordinate the activities of certain of the city departments engaged in matters affecting traffic regulations. The duties of the latter are advisory to the traffic commission and to assist in securing the interest and support of various representative organizations and the public generally.

The last part of that sentence will bear repeating: To assist in securing the interest and support of various representative organizations and the public generally. The work performed by the city departments will be in direct proportion to the support given by representative organizations and the public generally.

Acknowledgment.—The above is an abstract of a paper presented Oct. 2 at the 18th Annual Safety Congress.

Mileage of China's Highways Estimated.—The National Good Roads Association of China on the basis of actual investigations stated to have been made by their various branches estimated China's motor highways at 20,973 miles actually completed and opened to motor transportation.

Governmental Action for Curbing Traffic Accidents

A plea for hasty governmental action to curb the traffic toll of human lives which statistics show will mount to some 29,000 this year was made in a statement issued last month by the American Road Builders' Association.

The recent Safety Congress in Chicago, the statement says, heard a striking story of the methods used by private industries which spend millions each year in research and precautions to prevent fatal accidents and injuries.

The great road building industry, which spends nearly \$2,000,000,000 annually, has one of the most serious safety problems of any met in modern life. Control of the industry at the present is almost entirely in the hands of governmental agencies.

National, state, city, county and township bodies build and maintain the roads and streets as agents of the people.

Not the motorists alone, but the entire citizenry, is in hearty accord with rapid extension of road systems to every point. Motorists carry a large share of the expense in vehicle and gas taxes, but every tax-payer has his funds involved.

Every stockholder in privately-owned industries knows that great sums will be expended for safety as a part of the regular operation of the concerns. It is the modern way and has the approval of leaders in modern business and commerce.

All railroads and steamship lines have comprehensive safety programs. Some comply with legal requirements, which are rigid and detailed. Others go even further, in the adoption of safety features.

Aviation, newest entrant into the transportation field, embraced safety in its very infancy and aeronautic firms are cooperating with the government in strict licensing of pilots and flying schools and examination of planes, using every precaution for safety. The aeronautical section of the Safety Congress discussed governmental regulation of landing fields as a further step.

The highway movement which has more human beings involved than all the railroads, steamship and air lines put together has given much thought to universal safety. Manufacturers of motor vehicles have probably equalled the expenditures for safety of private drivers' licenses. Brake tests and motor vehicle inspection are mandatory in others. Legal codes for usage of streets and highways have been written, but these will never reach their greatest efficiency until they are made uniform, nationally.

Conferences have evolved systems of road signs to point out dangers and to stimulate safe driving. Road building specifications are being drawn with the

best thought along safety lines. New locations are eliminating bad curves and other driving hazards.

Grade crossing eliminations are everywhere recognized as desirable, by the public and by railroad and highway officials. Much can be done along this line, not only with railroad crossings but at road intersections, where grade separation speeds up through traffic, prevents congestion and practically eliminates accident danger.

The American Road Builders' Association desires, however, to point out that in ten years the number of motor vehicles using the nation's highways has increased four-fold. The highway mileage built has not kept pace. In 1918 there were 20 cars to every mile of hard-surfaced roadway in the United States, now there is estimated to be 39.

New roads and streets must be built rapidly or another decade will see this proportion doubled again.

Wider highways will solve the traffic problem in some places. New roads paralleling the old ones in others.

Practical study of traffic needs must be made before highways are widened or new ones built. No public funds need be wasted in the light of present day knowledge.

Rights-of-way must be established, specifications drawn, appropriations made and funds secured through additional taxes or issuance of bonds.

Any student of American road building progress knows that any road built wisely is but a temporary expense, and soon becomes a permanent investment paying huge dividends. All our roads that were properly planned and built have paid for themselves and are a continuing public trust.

The federal aid road law passed in 1916 soon made appropriations of \$75,000,000 annually for new construction in all the states. The total expenditures for roads from all sources have grown by leaps and bounds since then. In 1928 the federal appropriation would only have paid about one-twentieth of the nation's road building bill, yet the law remains the same.

New federal and state road laws may be necessary to meet the situation. A considerable revision of present road systems and methods of building may be found desirable through study of present road usage and future needs. Any plan is foolish that has no forward look.

All these things will take time. Meanwhile automobiles flow forth in a steady stream from all our factories and are absorbed into business and pleasure transportation by waiting buyers.

Traffic congestion and the death toll increases. It is time for definite increased action. More investments in new roads and betterment. No amount of safety precautions will be effective without wide roads and streets.

Improved Asphalt Mixing Plant Opened

New Patented Process Mixes Five Tons at Once

MIXING asphaltic concrete in a drum like a concrete mixer, only sealed air tight and under a 50-lb. air or steam pressure, is the new method employed by the Bridges Asphalt Paving Co. of St. Louis, Mo. This is quite a departure from standard pug mill methods of preparing asphaltic mixtures. The aggregates are dried and stored in the same methods as formerly, but from there on the process is different.

The sand, dust and chats or limestone aggregate, as the case may be, are raised to overhead bins by means of chain bucket elevators. The dust elevator is enclosed. Directly under the bins, over which the enclosed rotary screens are mounted, is a hopper into which all three bins above empty. This hopper is swung on a scale beam. The scale measures each type of aggregate separately. The aggregate, of course, is around the 350 deg. F. temperature required. The hopper is the shape of an inverted pyramid and has a hole about 1 ft. square where the pointed end of the pyramid would be. This hole is directly above the hole in the mixing drum when the latter is in the receiving position. Enough aggregate empties into the hopper to make a five-ton batch of asphaltic mixture.

The man who weighs out the aggregate also weighs out the asphalt cement. In place of the open top asphalt bucket of the pug mill type, this asphalt container is a small tank suspended on scale beams. Enough asphalt at the correct temperature is weighed out inside this tank to make the five-ton batch. The asphalt cement enters this little suspended tank under pressure and is forced into mixing drum under pressure also. Steam at 120 lb. pressure is used for this purpose.

The aggregate is dropped from the hopper into the mixing drum below, and the drum is then sealed. A mixing period of two minutes follows in which the hot aggregates are the only things in the drum. After this dry mixing period, the asphalt is introduced under pressure through a duct in the center of the axle of the drum. A 50-lb. air pressure is then put on the drum and the whole mixture is rotated for another four minutes. A minute is consumed filling and emptying the drum. This sequence permits from eight to nine 5-ton batches per hour.

Several advantages are claimed for this method, among them being: (1) Uniformity, no variation of mixture more than 0.5 per cent; (2) Economy of machine parts; (3) Economy of materials; (4) Economy of truck time; (5)

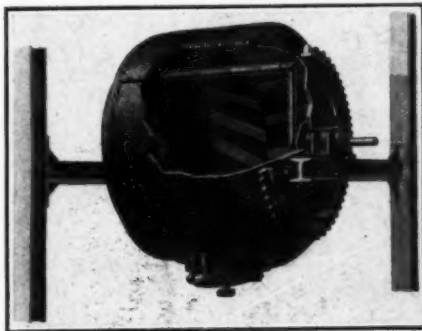


Fig. 2—Showing Drum as Used by New Process of Mixing

Accurate weighing of all aggregates; and (6) Impregnation and waterproofing of aggregates. The process is patented. The mixing drum is placed in service with the contractor on a rental basis. The contractor states that econ-

omies effected by using this process pays for the rental of the drum. No royalty fees are charged against the paving purchaser.

This plant was put in operation the morning of Sept. 10, 1929. The editor was present with the city asphalt chemist and contractor to witness the starting of this new process. The contractor stated that before this large plant was constructed, a small experimental plant was employed for considerable time.

The following crew is required at the plant: 3 men shoveling sand and chats, 1 man handling dust from cars to elevator, 1 man filling hopper and handling drum, 1 man on scales, 1 man emptying hopper and firing driers, 1 fireman, and 1 foreman.

The city maintains a laboratory at the plant for supervision and control of the mixtures. The first run was an

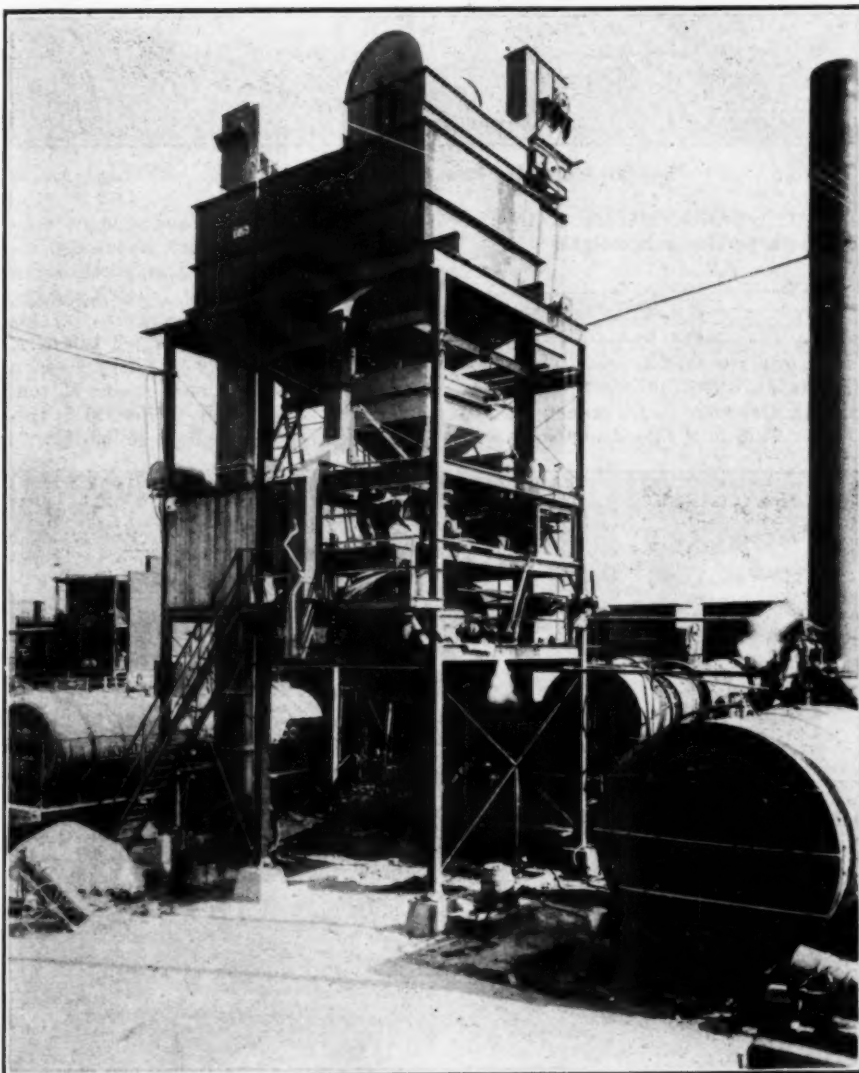


Fig. 1—General View of Asphalt Mixing Plant of Bridges Asphalt Paving Co.

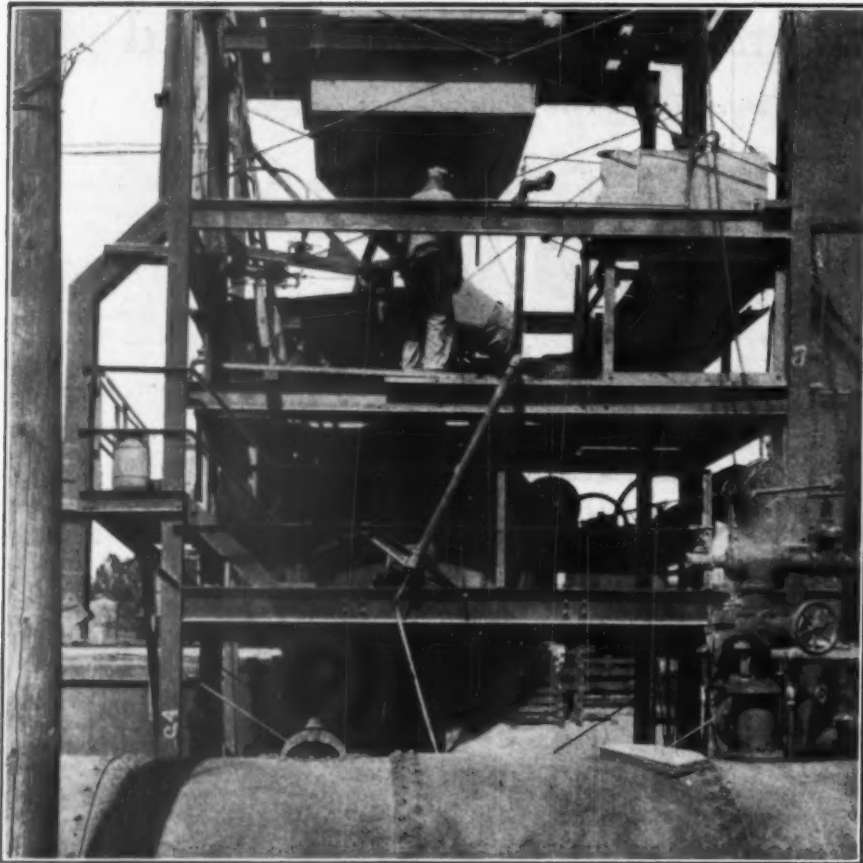


Fig. 3—Rotating Drum Mixes for 5 Minutes

asphaltic concrete mixture of the following proportion and weights:

	Per cent		Lb.
Bitumen	7.5	A. C.	760
Dust	7.0	Sand	6,000
Chats	25.5	Stone	2,540
Stone	60.0	Dust	700

The mixture was trucked about five miles in an open top dump body truck to Fair Grounds Pl., a short, narrow street. This is 2 in. of asphaltic con-

crete on a 6-in. portland cement concrete base. The mixture is dumped directly onto the base and shoveled to place with forks. The following gang organization is on the street: 1 foreman, 4 rakers, 5 shovelers, 2 tampers, 1 back man, 1 helper in back, 1 truck dumper, and 3 roller men on one 15-ton, 3-wheeler, Springfield roller and two 10-ton Buffalo-Springfield rollers.

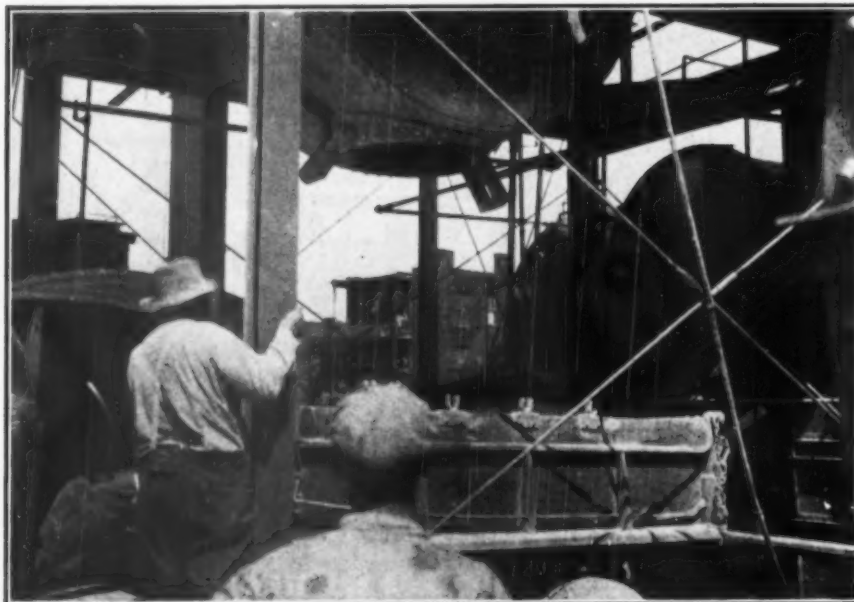


Fig. 4—Discharging 5-Ton Batch from Drum Into Truck

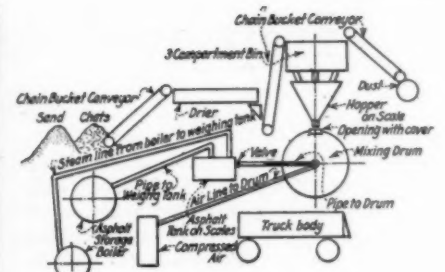


Fig. 5—Schematic Diagram of Plant

Those responsible are: Edward Bridges of the Bridges Asphalt Paving Co., contractor; C. E. Crider, contractor's superintendent; C. F. Stuart, street foreman; Chas. Geis, plant foreman; Mart Thompson, chief asphalt chemist for city; and C. W. Bornemann, city inspector on street.

Essentials of Zoning

Zoning essentials are summarized as follows in the City Record (Boston):

1. Zoning should be done as a part of a comprehensive city plan which takes into consideration: Future street requirements and the handling of traffic; parks and other recreation facilities; general transportation necessities; future school sites; and all other such problems as may have direct bearing upon the proper physical development of the municipality. Most intelligent and most effective zoning cannot be done otherwise.

2. Careful attention should be given that the drafting of the ordinance and the procedure in its enactment are in strict accordance with the state zoning enabling act.

3. Every provision of the ordinance should be measured against the criterion: "Is it in the interest of the general welfare? Is it reasonable?"

4. It should be held constantly in mind that every municipality has its own peculiar individuality and problems; that no ordinance drafted to meet the requirements of one commodity will fit the needs of any other. Verbatim copying of ordinances or parts of ordinances of other cities should be done with the greatest discretion.

5. It should be recognized also that the adaptation of the ordinance to the ground, as expressed in the zone map and in the placing of the district boundaries, is no less important and is frequently more difficult than the drafting of the ordinance.

6. The ordinance should be as elastic and as little arbitrary as is consistent with the general purpose of zoning. Nothing should be done to prohibit or make difficult the introduction of new ideas in housing and land subdivision, or to discourage well-advised experimentation in these fields. A competent Board of Appeals or Board of Adjustment should be included in the administrative machinery.

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The New Member of the Gillette Group, "Motor Freight"

Last June the first issue of "Motor Freight" was published, making the fifth member of the Gillette Group of Magazines. "Motor Freight" is devoted to the motor hauling of freight on schedule, and is the only magazine specializing in scheduled transportation of freight over highways. It bears much the same relation to *Roads and Streets* that "Railway Age" bears to "Railway Engineering and Maintenance," the two well known railway journals published by the Simmons-Boardman Publishing Co.

In the technical publishing field the trend is toward the production of several allied magazines by one publisher, Simmons-Boardman, for example, publish five magazines serving the railway field. The Gillette Publishing Co. now produces three periodicals serving the highway field, namely *Roads and Streets*, "Road and Street Catalog," and "Motor Freight."

With the advent of a large mileage of well surfaced highways, the haulage of freight by motor trucks has become a large business. Seventy steam railways are using motor trucks for short hauls and terminal service. We predict that it will not be many years before every steam railway will follow the practice of the seventy pioneers.

Motor truck registration in America now exceeds 3,100,000, and is increasing at a faster rate than passenger car registration. The total number of freight-train cars is about 2,500,000, which is four times the number of passenger-train cars; whereas conditions are reversed as to motor trucks and motor cars, the latter outnumbering the former about 7 to 1. But again we venture a prediction, and that is that within the next generation motor trucks will outnumber motor cars.

Aside from the increased mileage of paved roads no single factor will contribute more to the rapid increase in motor trucks than the use of pneumatic tires. Solid rubber tires limit not only the weight but the speed of trucks. In several states the highway laws as to wheel-loads are such as virtually to eliminate the solid tire in competition with the pneumatic tire. The old cry that motor trucks should be banned from pavements built for passenger cars has almost died out since the advent of the heavy pneumatic tire for trucks. There is, of course, a field for solid tires, but it is usually limited to slow moving service where no injury to the highway is inflicted.

Mr. Fred B. Lautzenhiser in a recent issue of "Motor Freight" said: "Legislation in the various states seems to be gradually driving the solid tire from the highways and this appears to be more or less justifiable, except in special cases, not only from the standpoint of highway conservation, but from that of the truck owner's cost sheets as well." In this connection it should be remembered that the tire costs per ton-mile are not the sole criterion, for the increased speed attained when pneumatics are used reduces several other important items of ton-mile expense.

It is not unusual for pneumatic tired trucks to attain a speed of 45 miles an hour. Of course high speeds involve increased gasoline consumption, but as opposed to this there is the saving in driver's wages and in fixed charges on the trucks when reduced to a ton-mile basis.

If the predicted great increase in the use of motor trucks occurs, traffic congestion on certain highways will become even more serious than it is now. Highway engineers must give serious consideration to such a possibility. Fortunately the rapidly increasing income from gasoline taxes makes it probable that most state highways will be widened almost as fast as the traffic increases. But unfortunately no such relief as yet exists for traffic congestion on city streets.

Property Rights and Parking

The following editorial under the head given above appeared in the "Chicago Tribune" for Oct. 15, 1929:

"Property owners near a neighborhood moving picture house in Chicago once successfully protested the use of their curb frontage for the parking of automobiles by patrons of the theater. The complaint was that the movie customers left no room for the residents to stop in front of their own homes and apartments; that the noise of starting motors at night was a nuisance, and that the occupants of the cars trampled lawns and gardens and left refuse behind them. Acting on the protest, police were instructed to prevent parking in the district.

"The remedy which gave relief to this neighborhood is not available to all property owners, nor is it entirely satisfactory, for an ordinance prohibiting parking ex-

cludes the automobiles of the property owners as well as of strangers. It was an expedient which may be applied in special circumstances, but which evades the question whether motorists have the right to leave their cars in front of any private property without the owner's consent.

"If claim has ever been made in court to the property right to the street in front of an estate and the right to prohibit parking there or the right to charge motorists for the privilege it has not come to our attention. We believe that this right might be established. No one questions the authority of a property owner to use his land either for an outdoor or indoor garage. Parking there is a privilege to be paid for. Why should he not have similar control over the street, for the maintenance of which he is assessed?

"Only by recognizing these property rights in the street will the parking problem be solved. Then the quiet of residential neighborhoods may be preserved and parking in business districts may be regulated in the best interests of the property owners."

This editorial carries a question which it is our desire to answer. We believe many another city has often thought of this same question and undoubtedly many property owners believe they have vested rights to the parking space in front of their homes.

If an ordinance were passed by Chicago along the lines suggested in this editorial we certainly would immediately promote a flourishing racket. We would obtain options from property owners in the business district for the sale of parking space.

"The Tribune" speaks of the right to use curb area in front of a private property as a property right. In this conception they are entirely wrong. The property from lot line, which is usually about 1 ft. inside of the sidewalk line in residential communities, on one side of a street, to lot line on the other side is city property. It has been dedicated and deeded to the city. The same is true in all towns and cities. Hence private property owners have no property rights, except by vote, to the parking space.

Directly answering "The Tribune's" question, private property owners should not have control over parking areas in the street before his property because:

1. It is city owned property.
2. His maintenance assessment is not spent directly on the street in front of his place but goes into a general city maintenance fund to be used on all the streets and intersections.
3. It will foster insidious rackets.
4. Citizens of a community have the privilege and right to use city streets which are owned by the citizens corporately. They delegate certain authority and duties to councilmen and police officials in order to expedite traffic, thus causing some "No Parking" conditions.
5. It will not solve the parking problem, for the rights to parking space will be leased out and cars remain parked in one place all day. The convenience of the few should bow to the convenience of the majority in our social setup, hence in certain places a "No Parking" action would serve to the best advantage.

The writer thoroughly agrees with "The Tribune" that relief should be designed for the neighborhood theatre parking nuisance in residential districts but believes a theatre garage would be a better solution than endeavoring to set up artificial property rights to street area in front of private property.

How to Get Better Streets

Perhaps no tax system will ever be regarded as ideal; but there may be some approximation to such a standard of perfection. Up to date the gasoline tax seems to be the nearest approach to an ideal tax, provided that the money thus raised is used for highway improvement and maintenance. Generalizing, we may define the ideal tax as one that is equitable and is collected as an incidental part of the price paid for goods or services.

If this generalization be accepted, then it follows that gasoline taxes should be increased sufficiently to provide funds for the widening and paving of all the main arteries of travel in towns and cities. There is no sound reason why an obsolete form of taxation should be permitted to remain in force as to streets, as is the case where abutting property owners must pay the entire cost of improving streets that serve as main highways. It has often been argued that the improvement of such streets enhances the value of abutting real estate, and that consequently the property owners should be taxed to pay for the entire improvement. In isolated cases the rise in value of real estate along an improved thoroughfare greatly exceeds the cost of the improvement; but there are many more cases where this is not so. When property owners balk at extensive street improvement, it must be assumed either that they lack common sense or that they fail to see a probable increase in the value of their holdings sufficient to offset the cost of the improvement.

Up to about a generation ago it was almost universally believed that the entire cost of country roads should be paid by the farmers. Result—practically no road improvement. The same belief still prevails as to city streets. Result—inadequate street improvement, particularly on main boulevards.

As you drive from a fine state highway onto a miserable city street, don't imagine that the residents of that street are all devoid of public spirit or sense. Just put yourself in their places and consider whether you would see prospective recompense sufficient to warrant improving a street at your own expense for the use of thousands of other motor car owners. Merely because those thousands will roll by your home with greater rapidity and greater ease may not add a dollar to the value of your home; so you let them grumble about your lack of public spirit—while you save the money that they want you to donate for their benefit.

We have yet to see a city that lacks abundant examples of narrow and ill paved thoroughfares. This condition will long continue unless the obsolete system of taxing abutting property for all street improvement be abandoned.

H. P. Gillette

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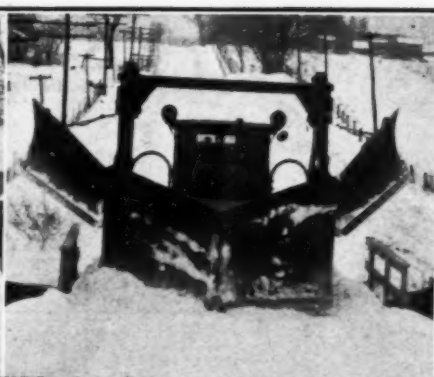
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Snow Removal Section



Equipment for Keeping the Streets and Highways Open to Winter Travel

Push-Type and Rotary Plows—Power Units for Snow Plows—Snow Loaders
Snow Melters and Ice Breakers—Snow Fence

A SURVEY of the varied problems met with in keeping the streets and highways of the nation open to traffic during the winter months convinces one of the wide variety of equipment required for dealing with the snow problem. Snow-fighting measures range from prevention of drifting to removal and disposal of fallen snow in kind, and from the use of light, convertible apparatus to employment of the heaviest type of specialized machinery in degree.

In the following pages, "Road and Streets" presents its annual review of snow equipment. Previous issues have emphasized the importance of a comprehensive winter program and have discussed means of making uninterrupted highway travel and city driving possible during the cold months of the year. In this review will be found the answer to every winter equipment need, whether the requirement be a few thousand feet of snow fence or a powerful rotary plow.

Equipment in the snow-fighting field has undergone sufficient development in recent years to assure purchasers of reliable performance. Typical designs have been developed for specified conditions. Within defined precincts, however, the designs of various manufacturers are still competing for favor, and users of snow equipment are presented with a sufficient variety of



A Walter Snow-Fighter Equipped with Reversible Front Plow and Center Side Wing

models in any class to allow liberal room for individual preferences.

Warco Snow Equipment.—The Warco snow plow is an attachment which can be applied to any Warco grader that is equipped for independent scarifier. It is built by the W. A. Riddell Co., Bucyrus, Ohio. This attachment makes an all-year tool out of the Warco grader, as the machine is used for maintenance in the summer time and for removal of snow during the winter. The plow, working in conjunction with

the grader blade, can handle a comparatively deep fall of snow.

The Warco plow is of the V-type and is attached to the front of the grader in the same manner as the independent scarifier. The plow is raised and lowered by means of a worm-and-gear mechanism controlled entirely from the operator's station. The plow is attached and detached to and from the grader. Warco graders can be supplied with crawlers and ice lugs, and these attachments increase the traction of the machine tremendously. The snow plow has a wing spread of 5 ft. 10 in. and is 24 in. high.

Walter Snow-Fighters.—The Walter Snow-Fighter has been designed and developed specifically for snow-displacement service. The Walter unit has a positive drive to all four wheels, assuring ample traction at all times. It is powered by a 100-hp. six-cylinder motor. The transmission has five forward speeds, all controlled by a single selective gear-shift lever. A speed of 25 miles per hour is secured in high gear. In low gear, a tractive force of 14,000 lb. is exerted.

The unit illustrated is provided with a reversible front plow and a center side wing. This forms an efficient highway patrol unit. A center scraper blade may be used in place of the side wing. This cleans right down to the road surface, thus preventing the formation of dangerous ice ruts which are caused by the vehicular traffic on freshly-fallen snow.

Walter units are supplied with standard types of dump bodies, or with special low-level garbage bodies, road oilers, flushers or wrecking bodies, so

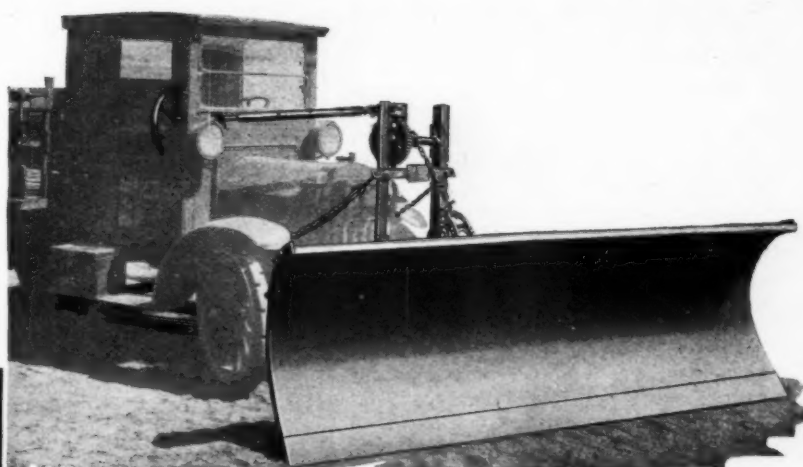


Warco Power Grader with Snow-Plow Attachment

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The Western 30-inch straight blade plow with 6-inch extension.

The Western "V" shaped blade used to buck heavy drifts.



Put one over on "Old Man" Winter

Communities using Western Convertible Snow Plows don't have to take a thing from "Old Man" Winter.

By attaching these plows to the front ends of motor trucks, many miles of road can be cleared of snow as fast as it falls. There are two types of Western Convertible Snow Plows, — the straight blade for average conditions and the "V" shaped blade for heavy drifts. Both blades fit the same frame. It is but the work of a few

minutes to change over from one type to the other.

Western Snow Plows are in the financial reach of all communities, large and small, both because of the cost and the convertible feature

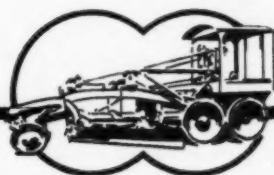
which affords a complete range of service.

Write for a special bulletin telling all about snow removing equipment. The Austin-Western Road Machinery Co., 400 North Michigan Avenue, Chicago, Illinois. Branches in principal cities.

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JAN. 13-18

Austin-Western ROAD MACHINERY

THE NEW



DUAL DRIVE

When writing to advertisers please mention ROADS AND STREETS—Thank You.

that they are useful for service throughout the year. They are manufactured by the Walter Motor Truck Co., Inc., Long Island City, N. Y.

Western Snow Plows.—Western snow plows, made by the Western Wheeled Scraper Co., Aurora, Ill., are made with both straight and V-type blades, each of which can be mounted on any 2-ton or larger motor truck. One of the most worth-while features of Western plows is that the two types of blade are convertible, both fitting on the same general framework. The substitution of one blade for the other is the work of but a few minutes. Because of this arrangement the operator who does not have constant use for both types, but who is likely to need first one and then the other blade at some time during the winter, is relieved of the expense of purchasing complete plows of both types.

Western plows are attached to the frame of the truck. This relieves the front axle of undue strain. The manner of attaching the plow to the truck is quite simple. The mechanism for lifting the plow consists of two vertical angles bolted to the plow frame and securely cross-braced and gusseted. These vertical uprights carry a shaft, on which are a chain spool and a worm gear of large diameter, operated by a hand-wheel in the truck cab. The lift chain is fastened to the chain spool. The hand-wheel shaft is supported through the dashboard by means of a small self-aligning bearing. The mechanism may be accommodated to any truck length or height. The frame of the plow is held steady and in the center of the truck frame by a pair of stay chains fastened to the plow beams.

The straight-blade plow has a 10-in. mouldboard made of $\frac{1}{4}$ -in. steel, flanged at the top and bottom for lateral strength, and provided with a removable 6-in. cutting edge or bit which gives the blade a total height of 21 in. A 30-in. blade is also available. The blade is reinforced by angles both vertically and horizontally. When set at the normal plowing angle of about 30 deg., the blade cuts a path about 8 ft. wide. The blade rolls rather than pushes the snow, and all the rivets in the face of the blade have countersunk heads to provide a smooth surface. The angle of the blade may, of course, be varied to suit the condition of the snow. An efficient blade release allows the blade to release itself when it strikes an obstruction which might otherwise do serious damage. The instant the lower edge of the blade strikes an immovable object it is pushed backward, and at the same time the top of the blade moves forward. Springs restrict this movement of the blade so that it is pulled back to its normal working position the instant the obstruction is passed. The blade is provided with renewable wearing shoes. A 6-in. blade extension may be added to



A Western Snow Plow of the Straight-Blade Type

give extra height to both the 21 and 30-in. straight blades.

The V-type blade cuts a path 8 ft., 9 in. in width. The blade is 34 in. high, including the removable cutting edge or bit, which takes all the wear. This bit is made in two pieces, one for each side of the nose. A renewable steel casting fits over the nose of the plow and stands the greater part of the abuse to which the V-type of plow is likely to be subjected. The blade is

made of $\frac{1}{8}$ -in. stock and the whole plow is of substantial construction.

Western plows have found a wide application. Their sturdy construction and the convertible feature have made and kept many friends throughout the sections of the country where the problem of snow removal must be met.

Austin-Western Equipment.—Motor graders make excellent machines for removing snow, and this is especially true of Austin Dual Drive models. The regu-



An Austin-Western Dual Drive Motor Grader Equipped with Special Snow Blade and V-Shaped Snow Plow

No Snow-bound Roads

With this Equipment



THE Bates "STEEL MULE" can be depended upon for every phase of snow fighting and snow removal. The Bates works easily in crowded streets and can be quickly turned within its own length. There are models to handle the lightest city work to the heaviest work encountered on drifted country roads. Always plenty of reserve power for the most severe conditions.



The Bates "STEEL MULE" is a year around tractor and no special models are necessary for snow removal or other winter operations. The several accessories on the "Snow Special" provide additional conveniences for various winter operating conditions.

THE BATES SNOW SPECIAL

Complete protection is provided by an enclosed cab with glass windshield and windows. Equipment consisting of electric starter, electric generator and lights, oil gauge, comfortable seat and controls makes maximum efficiency for every snow and winter operation.

MANUFACTURED BY
FOOTE BROS. GEAR & MACHINE CO.

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Chicago, Ill.



Send the coupon today for complete information on the Bates "Snow Special." No obligation of course

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Steel Mule



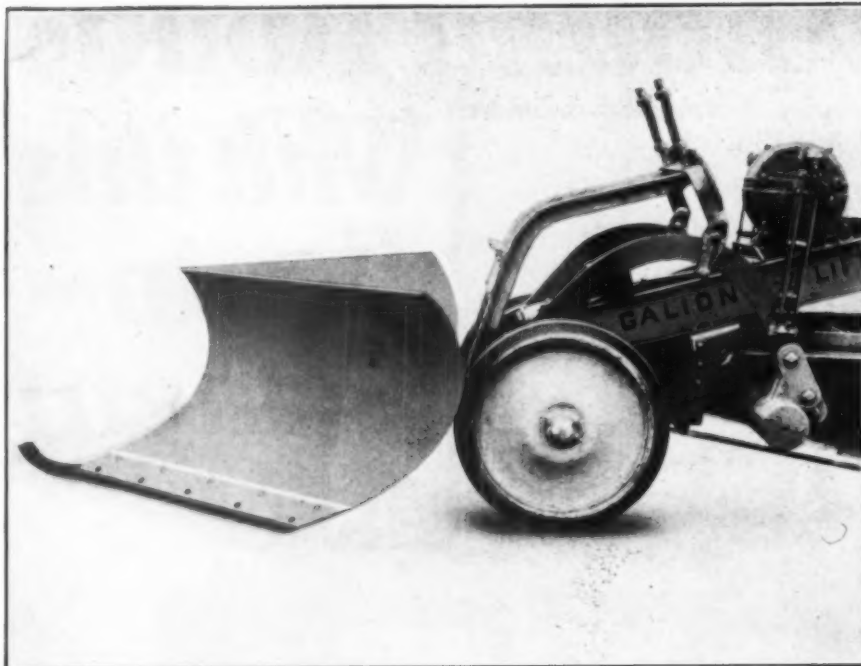
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Snow Plow Attachment for the Galion Motor Grader

lar blade will handle snow satisfactorily, but for really effective work, especially where the snow is deep, the use of the special snow blade and V-shaped plow is recommended.

The snow blade is higher than the regular blade, especially at the heel, and is properly shaped and curved to roll the snow rather than push it. The nose of the V-shaped plow will not dig,

and is adjusted by means of a limit stop. A counterbalancing spring makes it easy to raise the plow. Pressure is applied directly to the nose of the plow, and any side draft that may be developed is taken care of altogether on the grade frame. There is no strain on the steering gear. The snow blade and plow can be easily attached to any Austin dual drive motor grader, and

the machine can be changed from a snow plow to a grader in ten minutes.

A cab on a motor grader is a decided advantage and convenience from several standpoints. In the north, where these machines are used on snow-removal work, the advantage of a weathertight cab is obvious. In hot or dusty summer weather, and during rain storms, the operator is much more comfortable riding in a cab.

Two types of cab are available, a steel-frame cab with close-fitting canvas curtains, and an all-steel cab with sliding glass windows, double rear doors and a one-piece windshield. These graders are manufactured by the Austin-Western Road Machinery Co., Chicago, Ill.

Galion Snow Equipment.—The Galion snow plow, manufactured by the Galion Iron Works & Mfg. Co., Galion, Ohio, is designed for attachment to all Galion scarifier-equipped motor graders. The plow is V-shaped, properly curved and mounted to move snow. It is made of heavy steel, thoroughly braced. A runner is placed at the front to carry the plow over obstructions.

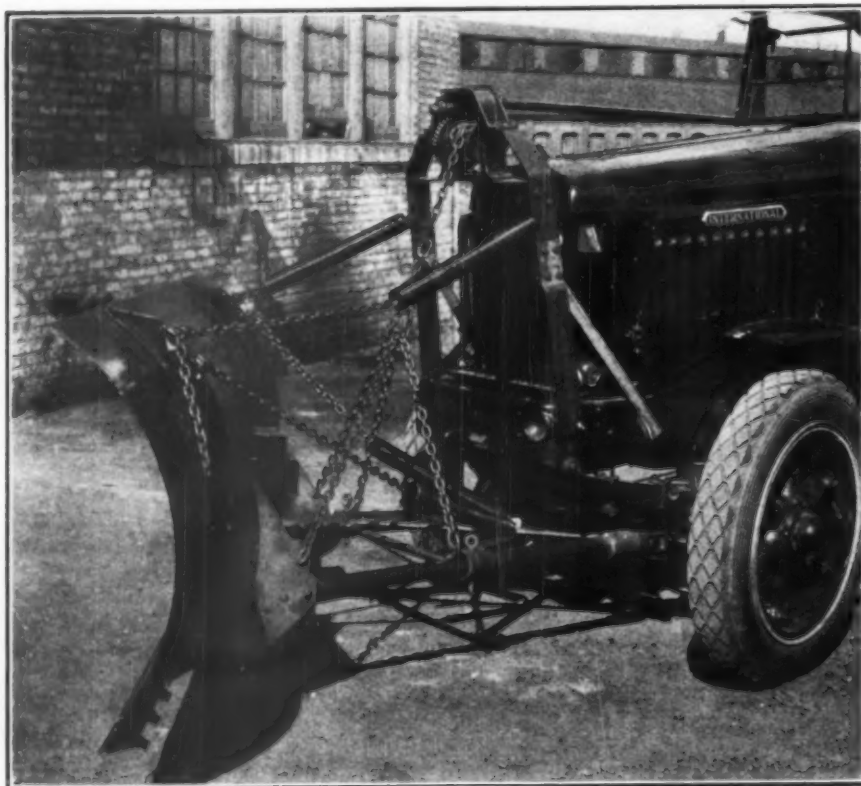
The plow is attached directly at the front of the grader frame, and the power is thus carried directly to the snow plow or breaker. The scarifier teeth are removed and the plow is operated by the scarifier mechanism. The weight of the scarifier block is so balanced against the weight of the plow that raising and lowering are easy. The proper adjustment of plow and grader blade for any condition can be readily determined by trial. The snow plow attachment makes the Galion grader an all-year-around piece of road machinery.

Gettelman Hi-Speed Snow Plow.

The Gettelman plow is manufactured by the Heil Co., Milwaukee, Wis. This plow, which is illustrated herewith, can be handled by a truck of 2-ton or larger capacity and, it is claimed, will clear a path at a speed of 20 miles an hour or more. It is stated that dry snow has been handled by 2-ton trucks traveling at a speed of 35 miles an hour. Because of the operating speed, the snow runs up the curved plow blade and spreads itself into a fan-shaped sheet, out over the roadside and into the adjoining fields. The truck driver's vision is not impaired in the least, say the manufacturers, as the action of the flying snow is forward and out, away from the front of the truck.

The Gettelman plow is made in 9-ft. lengths for 1½ to 2½-ton trucks and in 10-ft. lengths for 3-ton and larger trucks. All blades are 38 in. high. For light-duty trucks, short push arms place the center of the blade 46 in. from the center of the front axle. Longer push-arms for heavy-duty trucks make this distance 56 in.

Steel plate 3/16 in. thick is used in the blade. The cutting edge is made of high-carbon steel and the blade is reversible. Structural steel angles re-



Close-Up of the Gettelman Hi-Speed Snow Plow Mounted on an International Truck

Put **FWD** Trucks to Snow Removal Work!



FWD Trucks are made in 2 to 10 ton sizes . . . four wheel trucks, six wheel trucks, tractor trucks. Send for specific bulletins.



**FOR UNMATCHED PERFORMANCE
AND LOWEST COST**
per mile of snow moved...

Speed in clearing the highways of snow and the cost per mile tell you whether you are using the most efficient equipment. And by the same records you have the reason why FWD Trucks are so extensively used in this service.

FWD Trucks make up the snow fleets of many states and counties because they have better traction and power due to the four wheel drive principle which distributes the power to all four wheels. They can be used with any type of plow and travel at a good rate of speed.

Besides snow removal, FWD Trucks can be economically used for all purpose road work. Send for special snow removal bulletin. Write today.

The Four Wheel Drive Auto Co.,
Clintonville, Wisconsin

FWD
BACKED BY **D** **NATION WIDE SERVICE**

Yes—we would like you to mention **ROADS AND STREETS**.

inforce the curvature of the blade and the cutting edge. The push arms are telescopic tubes of seamless steel. All castings are electric steel, annealed and machined to jigs. Installation of the plow on any truck, the manufacturers state, requires only a few hours and is a simple job. Once the installation is made, it requires only a few minutes to detach the plow or attach it again. There are but three possible positions for the blade, and these have been predetermined by tests; thus the adjustment of the plow is not left to the judgment of the truck driver.

A commendable feature of the plow is the tripping action of the blade, which protects it against damage from obstructions. The blade is pivoted to the push arms so that it can tilt forward, and the tension springs and the counterbalancing effect of the snow bring the blade back to the scraping position. The deeper the snow, the more it helps the blade return to the operating position, because the pivoting point is below the depth of the snow against the blade. Another feature is the offset of the blade with respect to the truck. The discharge ends a foot beyond the truck wheels. This offset, it is claimed, minimizes the side draft because the pressure of the snow on the offset portion of the blade throws the pressure line to the rear of the steering knuckle of the front wheel. The effect of this is to make the truck nose toward the discharging snow instead of away from it. A further result is that the truck can remain on the pavement and still clear the snow beyond the edge.

The Gettelman plow is designed to be placed on the highway soon after the beginning of a snow storm and to



A Truck-Mounted Good Roads Plow

remain there until the fall ceases and the snow has been cleared away. This



A Good Roads Plow Mounted on a McCormick-Deering Tractor

policy of rapid snow removal has been found less costly than methods which

delay clearing of the roads after a storm. In addition, the highways are actually open for the full width of the road all of the time. Some state highway departments have found that the increased revenues derived from gasoline taxes, as a result of increased consumption, actually pay for the removal of snow under this plan. One county, with nine Gettelman plows attached to regular road-building and maintenance trucks, following this program, keeps more than 250 miles of main highway open at all times.

Good Roads Equipment.—The regular line of Good Roads blade-type and shovel-nose plows, familiar to all users of snow-removal equipment, will again be available for combating the paralyzing effect of this winter's blanket of snow. The simplicity and economy of the Good Roads-Westinghouse pneumatic lift have been responsible for its quick adoption by bus companies, truck operators, highway departments, street railways and others. This device allows the operator to operate the plow by means of an air valve and a latch rope, without having his attention distracted and with little addition to his physical effort.

Two new models have been added to the Good Roads line. The standard reversible blade-type plow has been improved by lengthening the caster fork stem and the substitution of a new push-frame hinge. Instead of the large square nut formerly used to raise or lower the plow for proper clearance, a special nut has been designed with a hinged projection, into which a handle may be fitted. This eliminates the necessity of using a wrench when making adjustments; one simply lifts the handle and turns the nut either way, the handle dropping to the vertical as soon as it is released. The new nut is self-locking; thus the plow clearance remains constant after an adjustment has been made, until a further adjustment is required. Furthermore, the handle is always ready for use and cannot be lost.



Chevrolet Truck with New Good Roads Light Plow

SNOGO

The Super Snow Remover

SNOGO is an efficient all-purpose snow remover.

Our Snogo catalog tells a complete story of SNOGO'S mechanical features, and of its work under varied conditions. A copy of this catalog will gladly be sent upon request.



—for CITIES

It is difficult to conceive of an all-purpose snow-remover . . . a machine that is efficient on city streets as well as on snow-submerged highways. But, there is a definite answer . . . the new working principle of SNOGO with augers that cut into snow regardless of its condition, supplying the fan which develops tremendous force. Working on highways or on airports, this fan force disperses the snow up to a distance of 100 feet in either direction. For city work, this same force is under control by the application of a hood. By virtue of this force, the largest trucks can be loaded at the rate of 3 or more per minute (we have loaded them in less than 10 seconds) to many times their normal cubic capacity. The front hood



—for HIGHWAYS

can be operated right down to the pavement, and against the curb, accomplishing a remarkably clean job. Loading is done from the side, so that the trucks may follow in an uninterrupted procession. An important and exclusive feature of SNOGO'S work is the complete removal of banks from highways. If the banks are allowed to remain, they form drift traps, and after successive snowfalls, speed equipment is ineffective. Snow removal on airports is of vital importance. A few inches of snow can cause the loss of a ship worth many times the cost of a SNOGO, and the loss of lives — not to be measured in terms of money. SNOGO clears the widest airport runways, completely disposing of all the snow without building banks. . . .



—for AIRPORTS



Klauer Manufacturing Co.

Dubuque, Iowa

Do you mention ROADS AND STREETS when writing? Please do.

The new push-frame hinge, used where the push frame attaches to the axle clamps, is now provided with two holes, one above the other. This allows proper connections regardless of the height of the axle from the ground. Formerly the hinges had but one hole for connecting to the axle. The height of the axle varies on different trucks, and with hinges having single holes this condition often affected the proper working of the plow.

There has been an urgent demand for a light blade plow for use in connection with the lightweight trucks, such as Fords, Chevrolets and others of from 1 to 2-ton capacity. An adaptation of a heavier reversible blade-type plow has been made for use on such truck equipment. A simple and effective lifting device, similar to the standard type but much lighter, has been developed in this connection.

The light plow has the universal axle clamps and the universal lifting-device clamps that are features of the heavier models. The new plow has a mouldboard length of 6 ft. 6 in. or 8 ft. The height is 20 in., including mouldboard and cutting edge. The approximate lifting height is 23 in. The mouldboard is made of $\frac{1}{4}$ -in. steel plate, reinforced by angles. The cutting edge is $\frac{5}{16}$ in. thick and 6 in. wide. It is made of special steel and is renewable. The push frame and lifting devices are light, but strongly made.

The other new model for the coming season will be a V-type plow of minimum weight, for use on trucks of $3\frac{1}{2}$ -ton and larger capacity. This plow, complete and ready for attachment, weighs 1,600 lb. The plowing width is 9 ft. 6 in. The height of the plow, in-



Martin Plow and Team Cleaning Snow from Sidewalk

cluding the cutting edge, is 30 in. at the nose and 38 in. at the rear. The lifting height is approximately 18 in. at the nose and 10 in. at the rear. The mouldboard sides are of $\frac{5}{32}$ -in. rolled plate and have an edge of special alloy, $\frac{3}{8}$ in. thick. These plows are furnished with the Good Roads two-speed lifting device.

Simplicity is one of the leading characteristics of Good Roads snow plows. The ease and speed with these plows can be attached to any standard make of motor truck, have caused them to be held in high favor by experienced snow fighters who know the vital importance of getting into action soon after the storm starts. Good Roads plows are made by the Good Roads Machinery Co., Inc., Kennett Square, Pa.

Martin Snow Plow.—The Martin snow plow, manufactured by the Owensboro Ditcher & Grader Co.,

Owensboro, Ky., and illustrated on this page, is a small, horse-drawn plow, used for cleaning snow from streets and sidewalks. This plow may also be used to remove snow from gutters, piling it in windrows away from the curb, whence it may be disposed of by other equipment. Many municipalities realize the necessity of providing clean sidewalks during the winter months and are finding Martin plows just the tools for this purpose.

La Plant-Choate Snow Plows.—Both truck and tractor plows are made by the LaPlant-Choate Mfg. Co., Inc., Cedar Rapids, Ia. The line comprises one-way and V-type plows for tractor mounting, tractor-mounted sidewalk plows, V-type and one-way trip-blade plows for motor trucks and special high-speed plows for motor trucks and buses.

LaPlant-Choate V-type plows for tractor mounting have the exclusive central pivot mounting, making it possible to throw the entire weight of the plow on the tractor when necessary. In unusually hard going when the track slips, the operator raises the nose of the plow about an inch, throwing the full weight of the plow on the tractor and giving the maximum amount of traction. The plow is operated hydraulically from the cab of the tractor. The driver sits in his cab, operating the plow by raising and lowering the wings with one hand by means of the hydraulic lifting device. Because of his comfortable working conditions it is reasonable to expect that he can work longer and more carefully than if he were exposed to blizzards and other dangers of outside operation. One man is required for operation. Mouldboard and wings are shaped so that the cutting edge cuts in under the snow and lifts it. The roll of the surface picks up the snow and throws it outward, to the side of the road. Hand-operated V-type plows are also manufactured.

LaPlant-Choate reversible blade plows also have the center pivot mounting and the hydraulic lifting device. They are operated by one man from the tractor cab. The blade is instantly reversible. The blade is allowed to overhang on the delivery side, with the result that side-draft is counteracted. A sidewalk plow is made for the 2-ton Caterpillar tractor. This plow is lifted through a worm-and-gear device by a hand-wheel in the tractor cab.

LaPlant-Choate truck plows may be attached to all makes of motor trucks. In the trip-blade plow the plow blade is mounted on a vertical pivot, so that it can trip backward when the lower cutting edge hits a protruding obstruction. The spring tension can be adjusted to whatever resistance is desired. The lifting device is operated from the driver's seat.

A LaPlant-Choate Caterpillar-mounted plow was used in the famous Colesburg expedition last year. This little Iowa community had been shut off from



A La Plant-Choate Plow and a Caterpillar Tractor Making Light Work of Heavy Going in Wisconsin

Grandfather Had Long White Whiskers

**and the sense to use the
best tools he could get**

**But the best of grandfather's brooms and shovels couldn't do Your job
cleaning the streets of snow from curb to curb**



The NELSON SNOW LOADER

for High-Speed Snow Removal

**does with gas what human labor cannot do
It is the best tool for the job that you can get.**

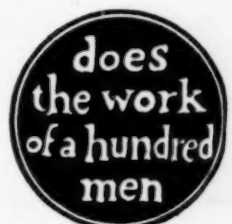
**Tread in the old boy's footsteps.
Show as much sense as he did
and at least ask us about it,
what it costs and what it will do.**

The N. P. NELSON IRON WORKS, Inc.

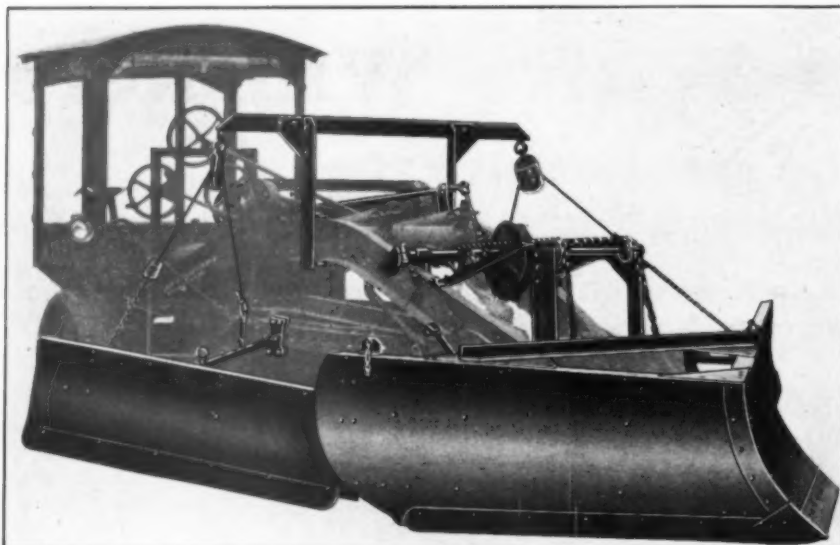
821 Bloomfield Avenue

Passaic, N. J.

it does not pay to shovel by hand when one Nelson



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Adams Snow Plow Utilizing the Adams Motor Grader

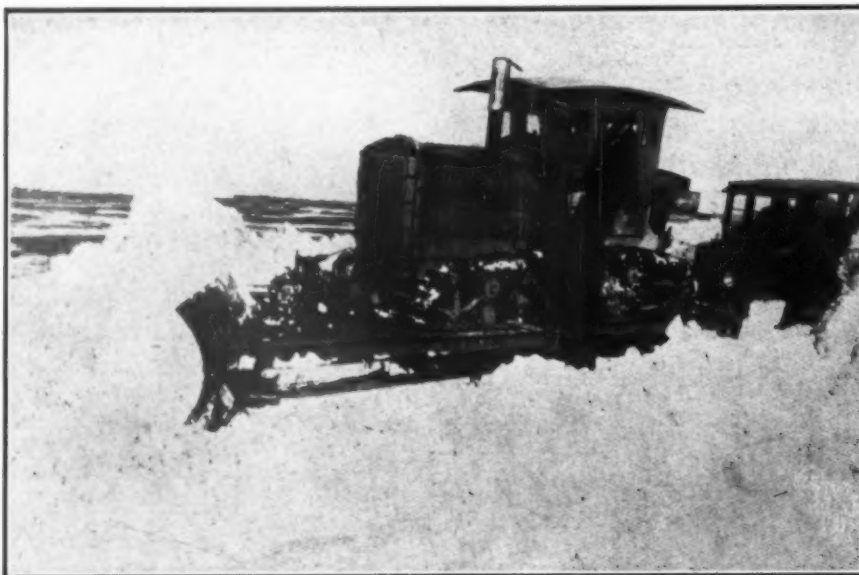
the outer world for days, for lack of proper equipment to combat the huge drifts which closed all of the roads entering the town. The tractor plow cut through 14 miles of drifts, many as deep as 8 ft., and reached the town after approximately 24 hours of work.

Adams Snow Plow.—In snow country the Adams motor grader should be put to profitable use during the winter months in helping to keep the highways open. This can be done by means of the snow plow pictured on this page, built in cooperation with the LaPlant-Choate Mfg. Co.

The complete plow consists of three major elements: the plow proper, the upright to which it attaches and the wings, including their lifting frame and several attachments. The plow is attached to any Adams motor grader without drilling any holes. Neither the mouldboard nor scarifier need be re-

moved. The upright frame is of heavy construction. The plow is of $\frac{1}{8}$ -in. sheet steel, riveted to a heavy frame. The plow is raised and lowered by the control ordinarily used for the scarifier attachment.

The plow may be raised to give clearance when transporting the outfit over bridges, railroads, etc. When lowered, the plow rides on three caster wheels, one at the nose and one at each side. These casters hold the plow at a constant clearance of $1\frac{1}{4}$ in. from the road. The plow is furnished with or without wings. Wings, however, are useful for many purposes and are recommended. The wings are raised and lowered through the blade-raising controls by means of pulleys and cables. They are fully adjustable to suit varying conditions. If it is desired to use the grader for other work during the winter, the plow proper can be disconnected in a few minutes, the manufacturers say,



A Baker Blade-Type Plow and a 10-Ton Tractor Opening Up a Highway in Kansas

and the upright can be left on the grader. The plow with wings cuts a width of from 8 ft. 6 in. to 16 ft. Adams motor graders are made by the J. D. Adams Co., Indianapolis, Ind.

Baker Snow Plows.—The Baker Mfg. Co., Springfield, Ill., builds a well-known line of snow plows for trucks and tractors. The plows are of both the blade and V-type, and are made in various sizes for attachment to various sizes of power units.

A feature of the Baker Auto Truck plow is the tripping blade, an attachment which is of extreme importance in preventing injury to the plow or truck in passing over manhole covers, crossings, car tracks and other unseen obstacles. The tripping blades, in sections 2 ft. long, are made of high-carbon steel and are hinged to the mouldboard or blade proper. Two strong compression springs, supporting each blade, force the blade to snap or trip back to normal position after being forced back by an obstacle. While the blades are tripping, the plow is fully supported by adjustable cast shoes. The plow is easily attached to the truck by means of clamps, and is controlled from the cab of the truck. A plow with rigid blade, having no provision for tripping, is also manufactured. This plow gets under packed snow or icy formations with ease.

The Baker V-type plow for use with motor trucks is a strongly-made, easily-attached unit, finding employment where it is desirable to throw the snow out two ways. The design of this plow is the outcome of careful study. The curvature of the mouldboard is such as experience has shown to be most satisfactory and which offers the least possible resistance to the movement of the snow. The plow may be raised bodily from 12 to 18 in. from the ground, from a hand-wheel in the truck cab. This plow can be attached without extras to any standard make of motor truck without drilling of holes in any part of the truck frame. Extension wings may be added to increase the width of surface cleared in one operation.

Both blade and V-type plows are manufactured for attachment to a number of models of tractors. Features of these plows are easy attachment to the power plants and a hydraulic lift, which saves a great deal of muscular effort and time over ordinary mechanical methods. Special models have been developed for use with Fordson, McCormick-Deering, Caterpillar and Cletrac tractors. Baker equipment is well built and has made a name for itself wherever it has been used.

Eureka Snow Plow.—The Eureka plow, manufactured by the W. M. Toy Co., Sidney, Ohio, is a one-man, horse-drawn plow, designed principally for the clearing of snow from walks.

This is a V-type plow, of all-steel construction. The wings are formed to impart a rolling motion to the snow

Whipping the Blizzards



FORGING AHEAD through the heavy drifts . . . steadily, mile on mile . . . faithfully keeping its trust . . . clearing the way for business . . . for fire protection . . . for the doctor's urgent call. ¶ Not just the highways—*every* road in your community must be kept open. And no equipment will do it more thoroughly, more quickly or more economically than a good snow plow driven by the sure-footed crawlers of a Trackson-McCormick-Deering. When winter is over this sturdy power unit is easily detached from the plow and used with one-man graders, scrapers, etc., thus providing year-round usefulness. Write for full details.



Model LH
Trackson-McCormick-Deering

Trackson Company

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FULL-CRAWLERS ★ BULLDOZERS ★ LOADERS ★ SHOVELS ★ CRANES

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Wausau Plow and Caterpillar Tractor Clearing a Minnesota Highway South of Rochester. Notice the Striped Wing Tips

and thus give the plow a light draft. The center beam is curved to permit the plow to pass over curbs or other obstructions without the driver dismounting. An anti-skidding device at the rear of the beam prevents the plow from swaying or skidding. The spread of the wings is readily adjustable by means of removable pins. Either wing can be removed for cleaning snow from gutters to permit water to drain off. The plow is securely riveted throughout. All parts are forged. The plow is made in three sizes, with blade depths of from 12 to 24 in. and wing spreads which range from 3 to 9 ft.

The Eureka plow is in use in over 1,500 cities. It is possible to think of a number of cases in which this plow will prove a useful supplement to heavier snow-removal equipment.

Wausau Snow Plows.—The Wausau Universal truck plow is the result of much research and usage on the part of men long experienced in the design and construction of snow-removal equipment. The mouldboard is rolled from heavy steel sheets. Extra-heavy cutting edges are made of wear-resistant material, and are so attached that replacements may be made with ease. The mouldboard is heavily reinforced by bulk heading, which gives maximum support at all required points. The contour of the mouldboard is such that the snow, instead of being wedged or thrust from the highway, is actually lifted and rolled in essentially the same way as soil is turned by a properly designed agricultural plow.

The push frame of the plow is not attached to the front axle of the truck, but is instead secured to the frame considerably in the rear. The push-frame brackets, one of which is attached to each side of the truck frame, are slotted, permitting attachment without alteration to different depths of truck

frame members and varying heights of trucks. The brackets are clamped in place; thus no holes need be drilled in the truck frame. The plow slides on heavy, adjustable shoes. A safety shoe is provided at the nose of the plow.

The lifting device of the Wausau plow is not installed on the truck frame, but is instead a part of the plow. The device is provided with a worm-operated drum, the worm being manipulated through a hand-wheel within the cab of the truck. Side-sway of the plow is prevented by two cables attached to the front axle of the truck and properly adjusted by turnbuckles. The Wausau Universal truck plow may be installed quickly and easily on any make or model of motor truck without the use of special tools or skilled mechanics.

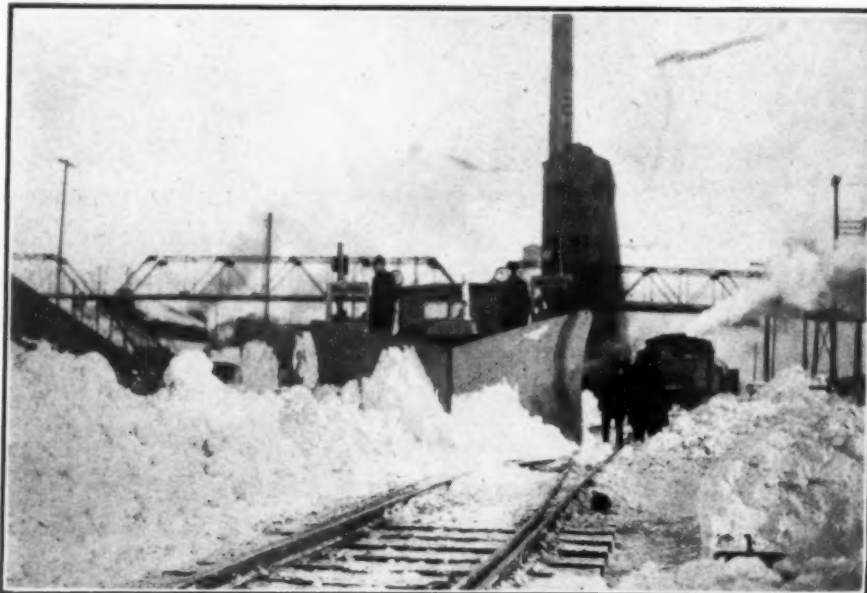
This plow may be secured in a number of different sizes, with and without wings. The Wausau Torpedo bus plow is a companion to the Universal truck plow, developed for the requirements peculiar to bus service.

A complete line of Wausau plows is also manufactured for use with the various sizes of Caterpillar tractors. Pictures of these sturdy units in action are shown on this page.

Wausau plows are a product of the Hi-Way Service Corp., Milwaukee, Wis.

Acme Snow Machines.—The Acme snow plow, made by the Acme Road Machinery Co., Frankfort, N. Y., consists of an Acme power grader, equipped with a V-type blade and wings. The purchaser has a choice of three different power plants: a Hercules engine, a McCormick-Deering plant or a Fordson plant. The grader may be equipped with either rubber tires or crawler treads.

The grader blade operates in the same manner as when used for power grading at other times of the year. It shaves and curls the first foot of snow into the side wings for banking. The position of this blade under the machine between the front and rear wheels allows more rigid control than any other position would, and permits the operator to observe its action at all times. It is adjustable to an angle of 49 deg. with the direction of travel. Either end of the blade may be raised or lowered independently. The V-type blade is proportioned to slice into the snow with the minimum of effort. The plow and the wings are easily removed at the end of the snow-removal season, leaving a power grader for maintenance work during the rest of the year. A 7-tooth scarifier, also useful for the regular maintenance work, is a useful tool for breaking up ice ruts.



A Wausau Caterpillar Unit Demonstrating Its Ability in the Railroad Yards at St. Paul, Minn.

Ross Snow Plows.—Ross one-way and two-way mouldboard snow plows are manufactured by the Batavia Steel Plate Construction Co., Batavia, N. Y. The Ross plow comprises three essential parts: the push frame, the mouldboard and connecting frame and the vertical lifting frame. The push frame forms the backbone of the unit. The mouldboard is fastened to the push frame through the medium of a swivel-hitch. The vertical lifting frame lifts the mouldboard to any position desired.

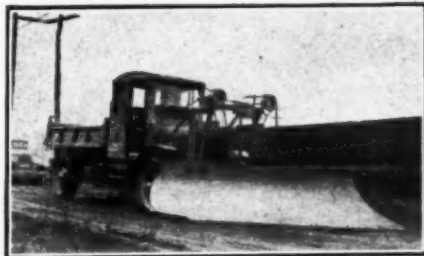
The Ross plow receives its pushing power from the rear axle of the truck to which it is attached. The connecting end of the push frame has a series of holes, making it adjustable to any length of wheelbase. No holes are drilled in the truck frame or other truck parts; the push frame is attached by means of a U-bolt which circles the truck spring at its base. The Ross plow is flexibly attached with a pivotal connection. This, the manufacturers state, allows the plow to maintain a correct position even when the truck wheels are traveling over bumps or in road depressions. The plow may be removed from the truck by taking out only one bolt. This can be done by one man without a helper.

The one-way plow is built in three sizes. The V-type plow is made in two sizes. The V-type is interchangeable with the one-way type at the point of the swivel-hitch. It is often sold in combination with the one-way plow, to provide complete front-end equipment. A side-leveling plow is also available.

Frink Snow Plows.—There is a Frink snow plow for every condition of snow removal. These are V-type plows, for mounting on trucks or tractors. They are manufactured by Carl H. Frink, Clayton, N. Y.

Frink plows are hung at three points with drive bars pivoted at each end. The mouldboards spread to a width from 2 to 3 ft. wider than the blade, leaving a beveled bank instead of a perpendicular one. The plows are built to weigh as little as possible and still withstand the hardest kind of plowing without buckling, the manufacturers state.

The rear of the plow can be tilted up or down, as conditions may require, through the medium of the drive bars. The blade is held in position by chains secured to the lifting device. Cast shoes about 12 in. long are secured to the bottom frame of the plow well toward the blade. These act as rockers when adjusting the rear or heel of the plow. The patented Frink lifting device, controlled by the driver, enables him to raise the plow clear of the highway without leaving his seat. Raising, adjustment and detachment of the plow are all quickly and easily handled, according to the manufacturers. Leveling wings may be added to the plow, to increase the cleared width or to trim off the tops of high banks.



A Ross Plow Equipped with Lights for Night Work

Sargent Snow Plows.—A rather complete line of truck and tractor-operated snow plows is manufactured by the Maine Steel Products Co., South Portland, Me.

The Sargent tractor plow is an adjustable plow of the V-type, provided with wings. A feature of this plow is the adjustability of the wings and the wing control. With the wings fully extended the Sargent plow clears a road nearly two and one-half times as wide as the nose alone. This enables the full power of the tractor to be utilized in light as well as in heavy drifts. Raised just above the snow level when the plowing is heavy, the inner end of the wing takes the moving snow from the nose before it loses its momentum and carries it far to one side where it does not have to be handled again. The wing may be set low and flat to scrape wide, clean roads, or it may be raised and sloped for side-bank work. Each wing is the equivalent of another plow, working high up on the side banks or off the road where the main plow cannot go.

Both ends of the wing are controlled at once by the Sargent differential wing hoist. Differential drums lay the wing flat in its lowest position, and raise it with a constantly increasing slope for heavy plowing or side-bank work, finally holding it in. All the adjustments in height and slope are made by turning one hand wheel. Cut steel gears and roller thrust bearings make for ease of operation. To handle side banks of unusual height, another hand wheel raises the inner end of the push arm so that the wing does not fold in at the top of its movement but extends far to the side and high in the air.

The cutter-bar is designed to hold



A Frink Plow with Leveling Wings. The Tractor Is a Cletrac

the plow down without holding it back. The two inches at the bottom of the bar are steep and sharp to undercut the hard snow. Above, the slope of the bar blends into the slope of the nose, to carry the snow up the wedge with the least effort possible. This plow is electrically welded.

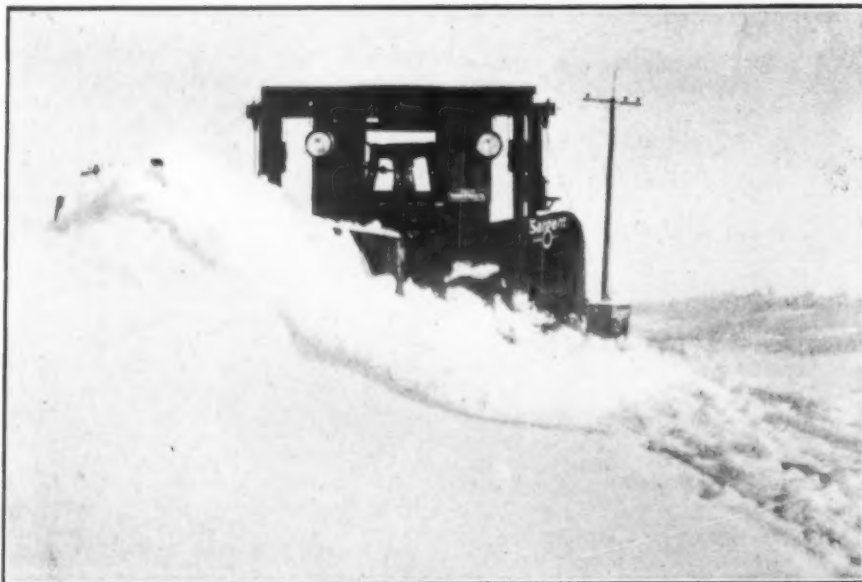
The Sargent Highway Special plow is designed for attachment to motor trucks of from 1½ to 5-ton capacity. It has the Sargent widening wing and differential wing hoist, giving an easily controlled unit, adaptable to all conditions. The wing can be lowered to scrape the surface of the road, or raised high in the air to convey the snow up over confining side banks. Where the road is narrow, the wing can be folded in out of the way.

The plow is attached to the truck body by means of slotted members, permitting a perfect fit whatever the size of the body may be. This body attachment also allows mounting without mutilation of the body. The plow is constructed of welded steel and has the same cutter-bar as the Sargent tractor plow.

Sargent wood truck plows are built of selected hardwood, reinforced by steel castings and angle-irons, thoroughly bolted and riveted together. The plow consists of a nose and two wings, and is so designed that it will ride over any obstruction in the road. Both nose and wings are concaved; the wings are adjustable and are held in any position desired by iron levers. The plow is made to fit any truck manufactured. All operating adjustments are handled from the cab of the truck by a single operator. The wooden plows are made in two sizes, light-duty and heavy-duty.

Trackson Units.—Many communities have found the ideal equipment for their winter needs to be a fleet of crawler-mounted, tractor-driven snow plows. Trackson McCormick-Deering Sargent units, answering this description, will handle everything from a light fall of snow to drifts as high as 3½ or 4 ft. Where there are only a few miles of road to be cleared, one Trackson can handle all of the plowing. A more effective scheme for larger districts or cities is to put several units to work almost as soon as the snow begins to fall and keep them working for the duration of the storm. In this way the snow does not get a chance to collect or pack to any great depth, and the work of clearing the roads is greatly simplified. The low investment, operation and maintenance costs of Trackson McCormick-Deering equipment, say the manufacturers, make it possible for state, county or local highway departments to operate a fleet of these units, assuring the district of uninterrupted snow removal. If one unit becomes incapacitated for a short time, the others go right on with the work.

The Sargent plow is a combination



Trackson McCormick-Deering Sargent Unit Breaking through Four-Foot Drifts in Barron County, Wis.

of a V-plow and a wing plow, and is so constructed that the wings may be kept in a raised or "folded" position for the first cut through deep, hard-packed drifts. For the second trip through they may be lowered and extended to cut a wide, clean swath. The nose of the plow may either be raised several inches from the ground so as to leave a layer of snow for sleighing, or be lowered to the ground level, in which case it will remove all of the snow.

Trackson McCormick-Deering units possess the advantage that the money invested in them is really spent for year-around equipment. As soon as the last snow has been cleared away, the plow may be detached and the tractor used the rest of the year for construction, maintenance and general utility operations. Thus a continual return on the investment is secured.

There are approximately 250 users of Trackson snow-plow units in the New England states alone. In addition, hundreds of other communities throughout the snow belt of the United States and Canada are doing all of their snow-removal work with this equipment. A wide use of Trackson equipment is also found among transportation companies. A great many cities, especially in Canada, have found one-man graders effective for removing ice and hard-packed snow from the streets, since the curved blade of the grader has a shearing effect. For this purpose also, Trackson crawler tractors furnish economical power for various makes of graders.

The accompanying photograph shows a heavy-duty Trackson McCormick-Deering unit breaking a road through heavy drifts in Barron County, Wis., after what farmers in that section described as "the worst snowstorm in fifteen years." The little crawler took

the plow through four-foot drifts like a veteran.

Trackson equipment is manufactured by the Trackson Co., Milwaukee, Wis.

Cletrac Power.—Cletrac tractors, manufactured by the Cleveland Tractor Co., Cleveland, Ohio, furnish reliable power for snow plows of all types. Cletrac units offer easy handling and quick turning, heavy-duty motors and adequate reserve power, cab enclosure of the driver's seat for warmth and protection and year-around adaptability. Cletrac models offer a power range of from 20 to 100 hp. They can be depended upon to

open up the biggest drifts under the worst conditions, to clear the steepest hillside roads or to bank up or load the season's heaviest snowfalls.

Two Cletracs were chosen to accompany Commander Byrd's expedition to the Antarctic. These two Cletracs with snow plows, scrapers, etc., are used for clearing and leveling suitable areas for landing the airplanes of the expedition, as well as for hauling supplies and materials over the ice.

The accompanying photograph shows a Cletrac equipped with a Sargent plow, in use in British Columbia.

Four Wheel Drive Trucks.—FWD trucks, made by the Four Wheel Drive Auto Co., Clintonville, Wis., are exceptionally well fitted to meet the problems of winter maintenance. This truck drives through all four wheels, and this results in a powerful unit, well adapted to snow-removal work. When the truck is fully equipped with snow-fighting equipment, the weight is equally distributed to the four wheels, providing adequate traction at each wheel.

The FWD truck holds to the road and goes straight ahead into the snow; there is no swerving or lifting of the front end of the truck. Whatever the depth of the snow may be, the truck holds its ground the full length of the run. This truck is powerful, it will handle any type of plow and it steers easily.

Almost any kind of plow may be used in conjunction with FWD trucks. In Massachusetts a fleet of 83 FWD trucks equipped with straight blade-type plows goes into service in different parts of the state as soon as the snow begins to fall. Rotary and V-type plows are also used extensively with FWD trucks. A



Cletrac and Sargent Plow in British Columbia

number of plow manufacturers recommend that FWD trucks be used with their equipment. The FWD truck is an economical piece of equipment, since it is an all-purpose, all-year-around truck. A picture of a FWD truck equipped with a Rightway shovel is shown on the following page.

Monarch Power Units.—One of the photographs on this page shows an Allis - Chalmers Monarch tractor equipped with a Baker plow and pulling an Austin-Western 8-ft. grader with a 12-ft. blade, clearing snow from Tennessee Pass in Colorado. This work is being done at an altitude of 10,000 ft. Heavy mountain work of this type demands the most efficient of methods and the most staunch and reliable of equipment. Monarch tractors, manufactured by the Monarch Tractors division of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., have proved their worth on snow-removal programs under conditions ranging from those pictured, to the mild snowfalls met with in the southernmost tier of snow-belt states.



Monarch Tractor, Baker Plow and Austin-Western Grader Opening Tennessee Pass in the Mountains of Colorado



A Caterpillar Tractor with a LaPlant-Choate Hydraulic Bulldozer Cleaning Snow and Ice from the Gutter on Michigan Ave., Chicago

Caterpillar Tractors.—Caterpillar tractors, manufactured by the Caterpillar Tractor Co., San Leandro, Calif., are used in the battle with snow the nation over—from the clearing of city sidewalks to the removal of huge quantities of snow from mountain passes. Many pictures on these pages testify to the widespread use of Caterpillars.

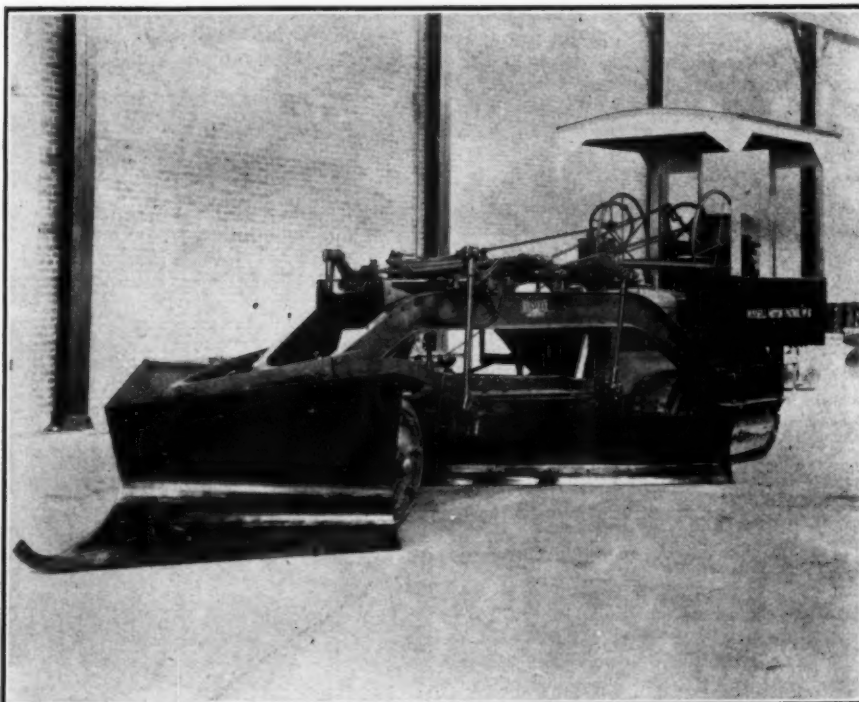
Caterpillars are used with one-way, V-type and rotary plows. Many plow manufacturers have designed their equipment especially for use in connection with Caterpillar tractors. A drag made of fitted timbers, connected behind the plow and tractor, clearing a strip as wide as 30 ft., is sometimes used as supplementary equipment. A small cab may be built on the drag, providing sleeping quarters and a store-room for the crew. In this way a double crew may be worked in sparsely-settled regions—one shift sleeping while the other works—thus keeping the outfit in continuous operation.

Caterpillars are also used to power combination plow-and-loader outfits, to

propel ice-breakers and to drive one-man maintainers equipped with plows. A sidewalk plow is made for the 2-ton Caterpillar. The versatility and reliability of the Caterpillar tractor make it a favored power unit wherever snow is to be moved.

Bates Steel Mule Power.—Bates Steel Mule tractors furnish reliable power for snow fighting. Models are available for all types of service—from the lightest

city work to the most severe conditions found on drifted country roads. The Bates works easily in crowded streets, the manufacturers state, and can be turned quickly within its length. The Steel Mule is a year-around power unit. In the special snow model, complete protection is provided by an enclosed cab with glass windshield and windows. The equipment includes electric starter, electric generator and lights.



Caterpillar Power Drives This Russell Patrol Fitted with Snow-Plow Attachment



A Bates Steel Mule Plowing Through Heavy Drifts to Open a Country Road

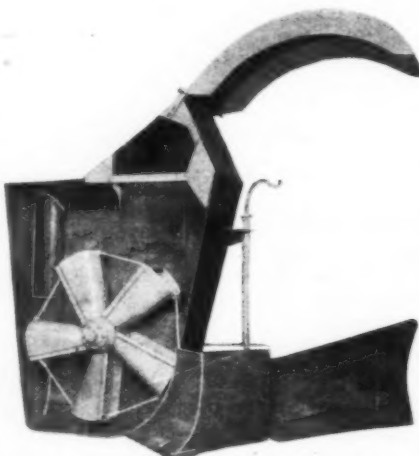
The Steel Mule is powered by a Waukesha engine with Ricardo head. The motor is placed back toward the center of the crawlers, so that its weight aids in the even distribution of traction. The radiator is protected from injury by the projecting crawlers. The low center of gravity increases the stability of the tractor. The drawbar is attached to the frame at a point considerably forward of the main axle, and this assists in holding the tracks more firmly to the ground. The Steel Mule has proved its usefulness under the most difficult winter conditions.

Rightway Rotary Snow Shovel.—The Rightway rotary shovel, built by the Rightway Corp., Chicago, Ill., is believed to be unique in design and operation. It consists of a V-type plow, over which is mounted a boom equipped at the outer end with a rotor whose axis is horizontal and perpendicular to the direction of travel. The rotor has seven trough-shaped shovels which are driven through a transmission by the vehicle engine. The rotor is brought into operation whenever snow too deep for the plow is encountered. The boom may be swung to either side and raised or lowered to engage the snow. The entire mechanism is controlled from the driver's seat by two levers.

As much of the snow as is possible, is removed by the mouldboard plow at a speed of 15 miles an hour. When the deeper drifts are encountered, the Rightway is brought into operation and the snow is removed from the road at a rate of 10 cu. yd. a minute, the manufacturers state. The rotor attachment has a sweep of 13 ft. 6 in. horizontally and a vertical lift from the roadbed of 9 ft.

Snow banks at the sides of the road are often responsible for drifting into the cleared roadway. The Rightway shovel may be used to dispose of the banks formed by mouldboard plows. In this work the shovel is swung to either side, set in operation and moved forward continuously. It is stated that as much as 25 cu. yd. of snow can be removed in a minute in disposing of banks, depending on the ability of the operator to keep the rotor buried in

the bank. In all kinds of work, the volume of snow to be handled can be regulated by the depth to which the



The Rightway Duplex, for Towns and Cities

rotor is buried. The speed and capacity of the Rightway have been calculated from actual tests made under difficult

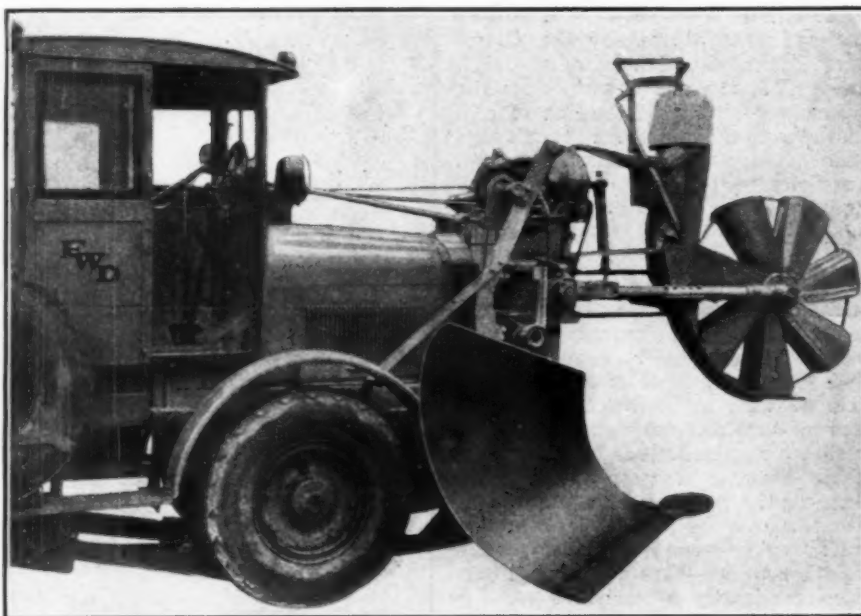
snow conditions on the upper peninsula in Michigan last winter.

The Rightway shovel is readily mounted on the truck frame. It can be carried on any truck having a rated capacity of 3 tons or more and powered by an engine developing 60 hp. or more. Power is furnished by the truck engine and is taken off at the front end of the crankshaft through a double universal joint. The swinging boom is driven through multiple disc clutches, which are adjusted to slip in the event ice or some other obstruction is encountered, thereby protecting the mechanism from undue shocks and stresses. The deflector maintains its position regardless of the position of the boom, thus enabling the operator to keep the snow directed continuously in a windward direction.

The Rightway Duplex is a combination snow loader, shovel and plow, developed for use in towns and cities. It is equipped with a 50-hp. auxiliary engine, and is designed for mounting on a crawler-type tractor. It will move snow from the road into a pile either at the curb or down the center of the street. It will climb over the curb and shovel the snow from the sidewalk into a pile or a truck. As a shovel and plow, the Duplex clears a path 10 ft. wide. As a loader, it furnishes a speedy means of conveying the snow from the roadway into trucks for ultimate disposal elsewhere.

Illustrations of the Rightway rotary shovel and the Rightway Duplex are presented herewith.

The Klauer Snogo.—Snogo is a complete snow-removal unit. The specialized Snogo unit is based on a new principle. In the hood of a Snogo are revolving augers. They cut into the snow as the machine advances, and carry it to a powerful fan which disperses it with force. Augers and fan are syn-



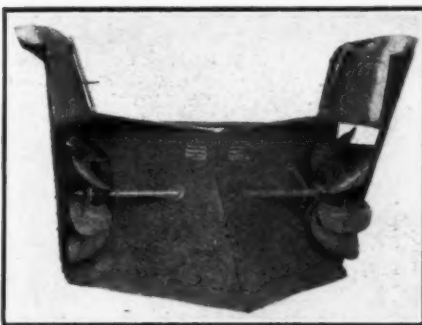
Rightway Rotary Shovel Mounted on FWD Truck

chronized, so that the fan cannot be over-supplied with snow at any time. This prevents the reduction in efficiency which would be a consequence of such an over-supply. Power is supplied by a 175-hp. motor. According to the manufacturers, Snogo will throw snow over 100 ft. to either side of the highway. For loading trucks in municipal work, Snogo is provided with a loading hood. The unit will travel at a speed of from 25 to 35 miles an hour between drifts, the manufacturers say. This is a valuable feature in light highway work where drifts occur infrequently.

Steering of Snogo when banks are being cut away is balanced by heavy steel blades mounted on each side of the front hood. By setting them to the required position, depending upon the quality and depth of the snow, side pressure is compensated for. Since the augers bring the snow from both sides to the center when a full cut is being taken, side pressure under these circumstances is equalized. Shear pins are provided to protect both the augers and the rotor fan; thus damage is avoided when buried objects such as rocks, logs, chains, etc., are encountered under the snow. Snogo has eight forward speeds, ranging from less than $\frac{1}{4}$ mile per hour in low gear with full engine speed to 25 miles per hour in high when not moving snow.

All of the controls are placed in the cab. The clutch control rod which disengages the entire front mechanism is within easy reach, ahead of the steering wheel. The raising and lowering of the front hood and the control of the spout are taken care of by an assistant. They are controlled by handwheels situated on the right side of the cab. The cab is heated for the comfort of the operator.

The discharge chute may be swung



The Snow King Standard Highway Model Rotary Plow

to the extreme right or left; thus the operator can throw the snow over obstructions and in the direction of a changing wind. Extension blades may be secured to mount above the front hood; this adds to the efficiency of the machine in deep snow. The width of the hood is limited to 7 ft. 10 in.; thus it is possible to run the entire unit into a heated garage whenever desired, for lubrication, servicing and storage.

In city work a clean job can be accomplished with Snogo by lowering the hood until it touches the pavement. To clear the whole width of the street the side of the hood can be run along the curb. When loading trucks, the snow is driven into the truck body with such force that it is compressed to three or four times its normal density, the manufacturers claim. This increases the truck capacity appreciably. Side loading permits the trucks to load one after another; thus no time is wasted maneuvering for position.

An important work performed by Snogo is the removal of the banks at the side of plowed roads. Bank removal eliminates water-soaked shoulders and consequent increased maintenance cost. Snogo is an economical unit for maintaining wide airport runways during

the winter, since it disperses the removed snow over a wide area and does not bank it up at the sides of the cleared path.

Snow King Rotary Plows.—Many of those in charge of snow-removal work are convinced that a plow which conveys the snow removed from the surface of the road and deposits it some distance away possesses advantages over the type of equipment which piles the snow in banks at the sides of the highway. Indeed, in deep drifts, a machine which will dispose of the snow without piling it up is essential.

Snow King plows, manufactured by the Rotary Snow Plow Co., Minneapolis, Minn., are designed to clear a wide swath in deep drifts and throw a stream of snow far from the edge of the road being cleared. The Snow King is a lateral-type rotary plow which is propelled by a truck or tractor. A number of different models are manufactured; however, these fall into one of two types, the standard highway model and a widening and loading plow for use on city streets and at airports.

As shown in the illustration, the highway model consists of a triangular frame on which are mounted two mouldboards, joined to form a wedge at the center. The outer edge of each mouldboard ends in a circular formation, within which is mounted a rotor. Direct connection is made to the motor crankshaft, power being transmitted by universal joints and a connecting shaft through the transmission of the plow to the rotor drive shafts. Four models are available for all sizes of crawler-type tractors from 20 hp. upward to the largest.

The plow is loosely attached to hitch brackets fastened at the sides of the propelling vehicle so as to permit of independent oscillation. The plow is raised and lowered by means of three



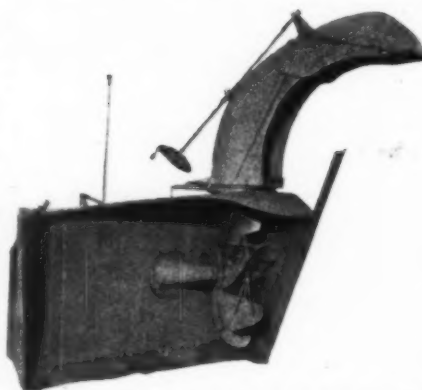
At the Left Are Shown Two Illustrations of Snogo Clearing Country Roads. Notice the Distance to Which the Stream of Snow Is Thrown. The Discharge Chute May Be Swung Through a Semi-Circle, Allowing the Operator to Control the Direction to Suit Conditions. The Illustration Above Shows Snogo Clearing Snow from a City Street. Snow Handled in This Manner Is Delivered Into Trucks with Force, Increasing the Body Capacity Materially. There Is No Necessity for Difficult Maneuvering or Backing on the Part of the Truck Driver

screws, so that the operator may cut to the surface or leave a covering of snow as desired. Means are provided for transporting the plow over bare surfaces without injuring the frame members.

Addition of side chutes has proved of great advantage, as snow can be controlled to prevent blowing back and the obstruction of vision during high winds. During the six years the Snow King has been on the market it has been improved to a point where it is fully standardized, the manufacturers state.

The Snow King widening and loading plow is intended primarily for use by municipalities and airports. A feature of this unit is its flexibility. It can cut into deep drifts, and then widen the cleared space, putting the snow at the curb or loading it into trucks or wagons. If the curb must be kept open, the snow may be deflected into yards and open spaces. This plow can be operated to discharge snow to either side. It is particularly useful for airport work, say the manufacturers, as a smooth surface is left and snow can be blown with the wind so as to be scattered without raising the level of the original fall appreciably.

The widening and loading plow may be attached to crawler-type tractors and trucks having four-wheel drive. As in the standard highway model, no separate motor is required as power is taken directly from the motor of the propelling vehicle. All working parts are of the same design as those employed in the standard highway model. An alloy-steel cutting edge is bolted to the bottom of the mouldboard. Timken bearings are used in the rotor mounting. An auger or rotor is attached to the inside of the rotor hub for crushing the larger chunks and to force snow into the rotor. The snow comes through the rotors like coarse salt. The rotor parts are protected by shear pins, which give way when an



The Snow King Rotary Widening and Loading Plow

immovable object is encountered and thus furnish protection against undue damage. The members of the plow are of steel, electrically welded.

Two men are required to operate this plow, one to drive the propelling vehicle and the other to look after the plow. When loading, the direction of travel is with the traffic. Snow is discharged at the rotor side, with the hauling vehicle running alongside under the hood. For widening and work other than loading, the plow travels against traffic. The rotor side of the plow is then toward the outer side of the street, with the hood in a position to throw the snow at the desired angle. An exception to this occurs when snow is being thrown toward the center of the street or into a center parkway; in this case, travel is with the traffic. It is claimed that a 5-yd. truck body can be loaded in as little time as 20 seconds, an average being about 45 seconds.

This type of Snow King is available in models to fit all sizes of crawler-type tractors rated at 20 hp. and upward, and four-wheel-drive trucks rated at 3½ tons or more.

The Rotary Snow Plow Co. also

manufactures the North Star speed plow and a separate wing for attachment to the side of a truck. These implements are useful for quick work in drifts which are too light to call a rotary plow into action. These units are designed for attachment to the same power units as the Snow King rotary plows.

Edwards Rotary Plow.—The Edwards rotary plow, made by the Ryan Car Co., 13501 Baltimore Ave., Chicago, Ill., clears a path 13 ft. wide in one trip, and throws snow clear of the right-of-way fences. The plow is built with two individual motors, which furnish power for revolving the two rotors. Both motors are equipped with electric starters and automatic governors. The plow is built to fit a 10-ton Caterpillar tractor.

Each rotor is made up of eight cones, made from shovel steel. Each cone is furnished with a removable cutting edge. The cones are electrically welded together to form one solid wheel. Each rotor weighs approximately a thousand pounds, is 5 ft. 6 in. in diameter and revolves on Timken bearings. The rotors are driven by silent chain drives. The rotors are designed to clear every obstruction ordinarily found on highways during the winter, including boards 3 ft. in length and 2 in. in thickness, bricks, rocks up to 12 in. in diameter, gravel, cinders and sand. However, shear pins are provided to protect the drive against overload. If the rotors strike a solid obstruction such as fence-posts or logs, the pins give way and relieve the machine of any chance of damage.

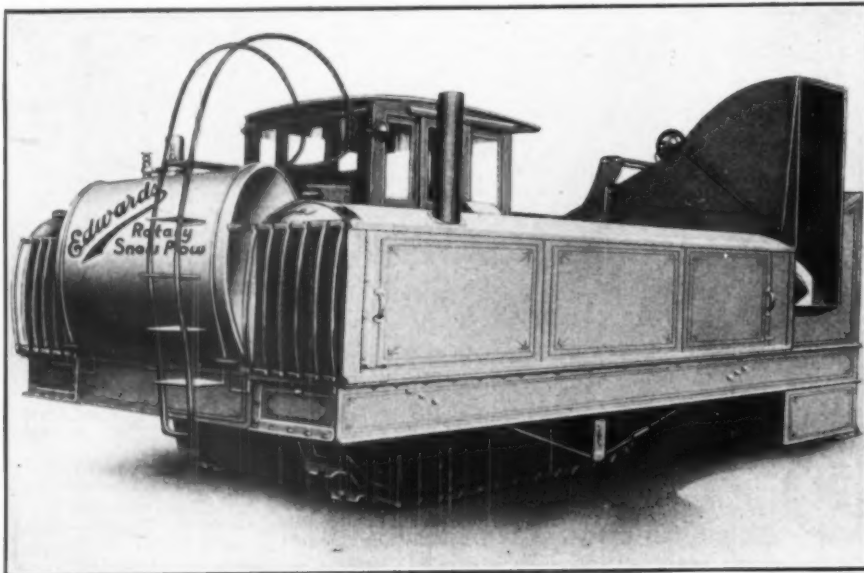
The plow is mounted at the center of each track of the tractor and hinges on that point. The depth of the cut is controlled by a power lift, connected to one of the motors and controlled from the seat of the tractor. The front end of the machine can be raised 24 in. from the ground in 30 seconds, the manufacturers state. Each rotor may be run separately if desired.

The weight, including a 10-ton tractor, is 38,000 lb. The overall length of the plow is 30 ft. and the height is 12 ft. The plow cuts a 13-ft. swath.

Link-Belt Grizzly.—The Link-Belt Grizzly, designed and built by the Link-Belt Co., Philadelphia, Pa., has been used for loading snow by a number of cities. It is stated that this machine has loaded 5-ton trucks in Philadelphia in a little more than a minute.

According to the manufacturers, this machine turns around in practically its own length, and its construction is such that the snow is gathered and brought to the buckets almost without the assistance of hand labor. A small turning radius is a real advantage in most classes of work. The Grizzly is mounted on heavy crawler treads.

In warmer weather, this loader will be found handling sand, stone, gravel or coal; it is a year-around machine.



Rear View of Edwards Rotary Plow, Showing Discharge Chute



A Nelson Snow Loader at Work in New York City

Nelson Snow Loaders.—The Nelson snow loader was designed especially for the snow-handling requirements of municipalities. Practical operation requires that a loader shall excavate and handle, not only the new-fallen snow and relatively soft piles, but also these piles after they have been rained on and frozen. The loader may also be required to cut out a layer of hard ice under the piles and next to the pavement.

To meet these conditions the Nelson feeder is set down close to the pavement, in advance of the scraper. The feeder consists of toothed spirals of tough, hardened steel, reaching in close to the conveyor flights. It is claimed that this loader cuts the ice clear across the scraper path and right down to the ground. The scraper moves back into the space cleared by the feeder. The feeding device delivers the snow and ice into the conveyor, which carries the material up on its lower strand, the flights returning empty on the upper strand. Delivery to trucks is made through a swiveled chute.

Conveyor and feeders are driven together as a unit direct from the engine crankshaft, controlled by a single friction clutch, and entirely separate from the traction drive. By this arrangement the loader may be moved back or forth at any selected speed with the conveyor either stationary or running, as may be desired. The loader has eight speeds, ranging from 8 miles an hour down to 30 ft. a minute. The loader is equipped with lights, permitting efficient night work. This loader is a year-around unit, as during the spring, summer and fall it can be used to handle earth, sand, ashes, gravel and coal.

According to the manufacturers, the capacity of the loader is from 10 to 15 cu. yd. a minute in new snow and from 5 to 8 cu. yd. a minute in old snow. It will load sand, earth, ashes, coal or gravel at the rate of from 2 to 3 cu. yd. a minute. Many cities are using this loader with satisfaction, having found, the manufacturers state, that it does the work of a hundred men. The Nelson

loader is made by the N. P. Nelson Iron Works, Inc., Passaic, N. J.

Joy Snow Loader.—The Joy snow loader is manufactured by the Joy Mfg. Co., Franklin, Pa., widely known as builders of mechanical coal loaders.

The Joy loader is a self-propelled, four-wheel, conveyor-type loader. The conveyor is fed by the Joy patented gathering arms, which sweep and dig the snow in a horizontal plane into the conveyor. The loader is operated by one man from a driver's seat on the left side of the machine.

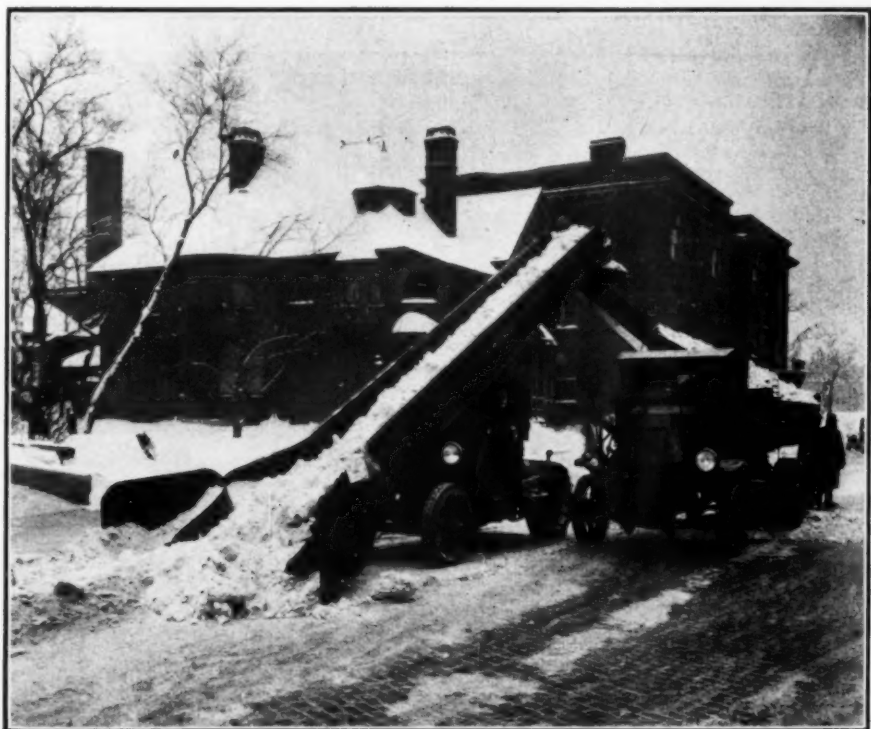
The loader is driven by a four-cylinder Hercules engine. Power is transmitted from the engine clutch through a flexible coupling to the transmission. Two clutches are provided, one for the conveyor and the other to drive the loader. These clutches may be oper-

ated independently of each other. With the engine running at 1,200 r.p.m., the loader has six forward speeds (from 70 to 688 ft. per minute) and two reverse speeds (95.2 and 208 ft. per minute). With the engine running at 1,800 r.p.m., a maximum traveling speed of 12 miles per hour is attained.

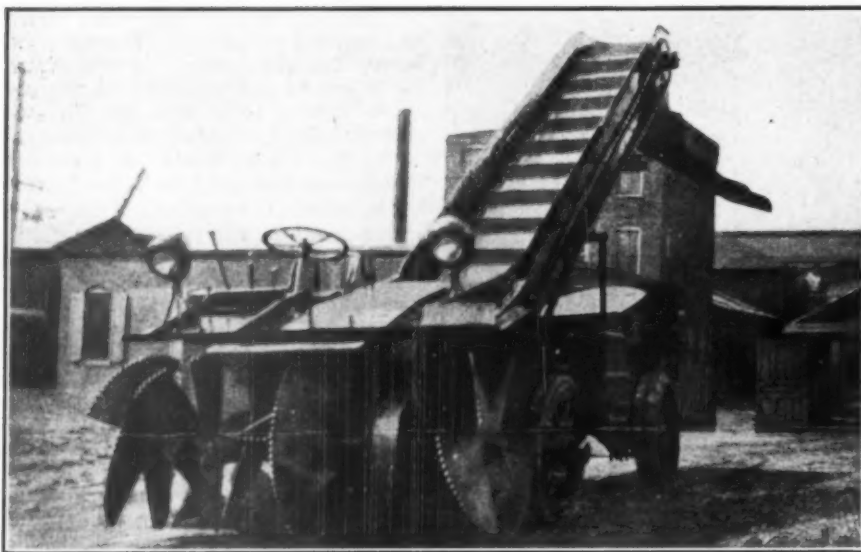
The conveyor consists of two steel roller chains carrying cross-flights spaced 13 in. apart. The width of the conveyor trough is 29 in. and the height of the sideboard is 16 in. The capacity is from 10 to 20 cu. yd. per minute, depending on the character of the snow or ice to be loaded, the manufacturers state. The gathering arms at the feeding end are of manganese steel and will clear a path 7 ft. 8 in. wide. The conveyor clutch is adjusted so that if the arms should encounter immovable articles, the clutch will slip back without stalling the engine, permitting the driver to back up a few inches and relieve the arms. The elevation of the conveyor is controlled by two hydraulic jacks. The conveyor can be held in any position between horizontal and a slope of 30 deg.

The Joy loader has a 120-in. wheelbase. Its overall width is 8 ft. 9 in. and its overall length is 34 ft. 7 in. Its overall height when loading is 14 ft. 6 in. and the height under the swinging chute is 7 ft. 2 in. The swinging chute has a 6-ft. radius. The weight of the loader fully equipped is 16,700 lb.

Fox Snow Loaders.—The Fox loader, manufactured by the Fox Rotary Snow Broom Co., New York, N. Y., was designed for the loading of snow only, with the especial problems of snow removal definitely in mind. This machine,



The Joy Loader, a Successful Machine for Municipal Work



Fox Rotary Snow Loader Ready to Go to Work

the manufacturers state, will load 100 cu. yd. a minute and will throw snow 9 ft. from the side of the highway. It travels at from $\frac{1}{2}$ to 15 miles an hour. It possesses the advantage that the driver does not have to back his truck to load; he can load from either side or from the rear. The escalator can be lowered automatically to its traveling position in 10 seconds. The Fox loader is made of steel throughout and is equipped with Hyatt roller bearings.

In Cleveland a Fox loader put on a load of $6\frac{1}{2}$ yd. in 23 seconds, it is reported, and 20 trucks were loaded in an 18-minute period. This includes the time it took all the trucks to get to the loader and away from it. In Chicago it was found that the loaders

would load a truck in from 35 to 55 seconds, keeping ten trucks going. Buffalo and Montreal also report entirely satisfactory service from the loaders. The loader can be used to load sand, gravel and ashes also, but it is a snow loader first of all.

Another useful implement for municipalities is the Fox rotary snow broom, favorably known to many officials. This machine may be used for sweeping city streets out of the snow season.

Barber-Greene Snow Loaders.—The accompanying photograph is an excellent illustration of the work performed by Barber-Greene snow loaders. This loader is a self-propelled, crawler-mounted, end-discharge machine. The feeding end is provided with two plows,



A Barber-Greene Snow Loader Piling Up a Big Load

mounted so that they may be adjusted to pass obstructions such as manhole frames. The elevating conveyor is a 4-ply rubber belt, 32 in. wide, fitted with cross-angle flights every 20 in. The snow is discharged at an elevation 11 ft. 10 in. above the pavement level. A separate trailer may be secured for side discharge. Power is furnished by a 4-cylinder Buda gasoline engine. Three forward speeds may be obtained, $37\frac{1}{2}$, 75 and 150 ft. a minute. The loader travels 40 ft. a minute in reverse.

The economy of using snow loaders has been demonstrated time and again by municipalities and street railways all over the country. Barber-Greene snow loaders, manufactured by the Barber-Greene Co., Aurora, Ill., have been used for five seasons in many of the large cities of the United States and Canada, and in numerous smaller ones.

The Ottawa Electric Railway Co., Ottawa, Ont., found that one of the loaders performed the work of from 60 to 70 men and that it was possible to fill a 5-yd. truck to a peak load in from 20 to 45 seconds. Horse-drawn sleighs were also loaded successfully with the loader.

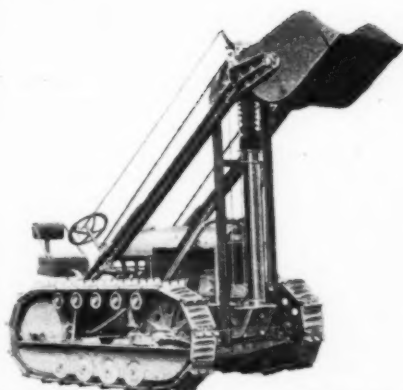
In Madison, Wis., a loader is operated by one man with two helpers. It is reported that city blocks were cleared of snow in 15 minutes that would have required two hours with a gang of 10 teams with four shovellers to each wagon. The machine used in Madison is of the end-discharge type. Loading is begun at the rear end of the truck instead of at the end toward the cab; this allows the driver a view, so that he can more readily regulate his speed in backing.

In Schenectady, N. Y., it is estimated that a loader replaced 96 shovellers. Three-yard trucks were loaded at an average rate of three yards in two minutes and a 7-ton Mack truck was loaded in 45 seconds, it is stated. By using the loader, six trucks were able to do work which tied up twenty before.

In Springfield, Mass., an average of one 5-ton truck load every two minutes was maintained over a period of six hours. The best record for a single load was one truck in 20 seconds. High speed was obtained by putting two operators on the machine, one man steering the machine and attempting to keep the belt full, and the other giving all his attention to the discharge.

Chicago, Milwaukee, Detroit and Boston are other large cities which have used Barber-Greene loaders profitably. In Boston a record of 112 hours of continuous loading was established by the Boston Elevated Railway Co. The average output was 1,600 cu. yd. in 8 hours, and the maximum attained was a 7-yd. load in 45 seconds. Each loader was served by from 6 to 25 trucks. The cost of loading with the loaders, it is stated, was 7.6 ct. per cu. yd.

An advantage of the Barber-Greene machine is that it can be converted into



The Blair Hydraulic Digger Is an Efficient Snow Loader

a bucket loader for other uses during the months of the year when snow removal is not a problem.

Blair Hydraulic Digger.—This powerful digger and loader, manufactured by the W. M. Blair Mfg. Co., Chicago, Ill., is powered by the McCormick-Deering tractor. Municipalities and large companies with snow-removal problems have found the high-lift model an ideal machine for this purpose. The tractors can be furnished with crawlers or rubber tires. The Blair digger will load from 300 to 500 cu. yd. of piled snow a day, the manufacturers state. In the summer time the same unit may be used for handling refuse or other material.

The bucket is made of $\frac{1}{4}$ -in. steel, electrically welded and riveted. It has a capacity of $\frac{3}{5}$ yd. The high-carbon-steel cutting edge is riveted to the bucket, allowing replacement. The high-lift model has a dumping clearance of about 7 ft. The bucket is raised, lowered or held in any position by means of a control lever mounted within convenient reach of the operator. The bucket may be dumped at any height. The high-lift model weighs about 1,800 lb.

Haiss Snow Loaders.—Haiss loaders, made by the George Haiss Mfg. Co., Inc., New York, N. Y., have been found advantageous by many cities for the quick removal of snow from congested areas. Where highly-developed plowing equipment is used to clear paths through the snow blockade, mechanical loading is almost essential if removal is to keep up with the pace of the plows, unless an army of men with shovels is available for this work.

Haiss loaders, it is claimed, load wet and dry snow with equal ease at the rate of a 10-cu. yd. truck-load in from one to two minutes. The loaders will scoop up dry snow, dig into sticky wet snow and chop their way through frozen snow. Men with picks and shovels are unnecessary. The manufacturers estimate that a single loader will save in the neighborhood of \$60 truck rental a day, as a result of the decreased loading time made possible by the loader.

The speed of the Haiss loader under varied conditions is made possible by the efficient feeding end of the machine. Self-feeding manganese-steel propellers dig into the snow bank and deliver the snow in small pieces to tooth-edged conveyor flights, which convey the snow to the loading chute. A clean-up scraper back of the propellers pushes all spillage back under the feeding device.

The conveyor flights are attached to double-strand elevator chains, which pull the flights over a sheet-steel pan extending up the elevator boom. The



Haiss Loader Feeding into Truck

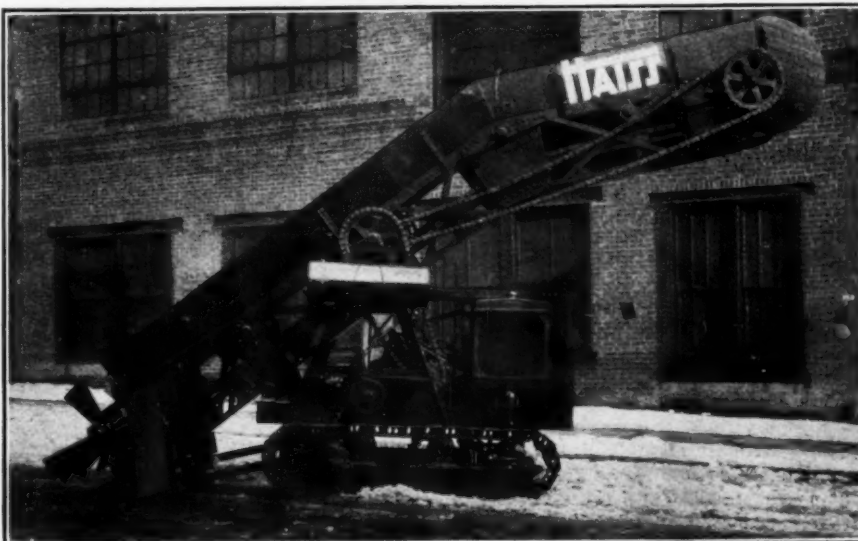
flights turn around at the end of the conveyor pan, where the snow is dropped on to the loading chute. This

conveyor system minimizes the possibility of snow sticking to parts of the loader and thus cutting down the capacity of the machine.

The loader is powered by a 41-hp. Waukesha gasoline engine. Power is transmitted from the engine to the transmission countershaft by a triple-strand drive chain, guarded by a heavy sheet-steel cover. The Haiss-built transmission is totally enclosed. The loader is mounted on crawlers, and is heavy enough to be held against the face of the snow bank even when digging into frozen snow. The forward speed is 96 ft. a minute, and the loader travels 65 ft. a minute in reverse. In addition, a crowding speed of 9 ft. a minute enables the operator to keep the machine constantly against a big snow pile, insuring full-capacity operation. Discharge into trucks is through a swivel discharge spout, manipulated from the operator's platform. The path dug by the loader is 8 ft. wide.

The accompanying photograph shows a Haiss loader in action.

Bucyrus-Erie Shovels.—Gas shovels have been used successfully for opening mountain passes where snow has drifted to great depths. An instance of such work was the use of a Bucyrus-Erie shovel for opening Fall River Road in Rocky Mountain National Park. Drifts here are from 20 to 30 ft. deep, and weather conditions make work impossible before about May 15 each year. A special $1\frac{1}{2}$ -yd. snow dipper was used and the shovel was equipped with a special high lift, giving it a dumping height of 21 ft. above the road. The drift was mostly on sidehill sections, and all snow was dumped on the lower side. For some sections, where the drift averaged 24 ft. in depth, special mats were built of 3x12-in. planks. Four mats were employed, and in this way it was possible to run the shovel into the drift 5 ft. above the roadbed, giving ample clearance for dumping.



Haiss Gooseneck Loader. No Discharge Chute Is Used on This Machine



Bucyrus-Erie Shovel Working in Fall River Pass at an Altitude of 11,797 Ft.

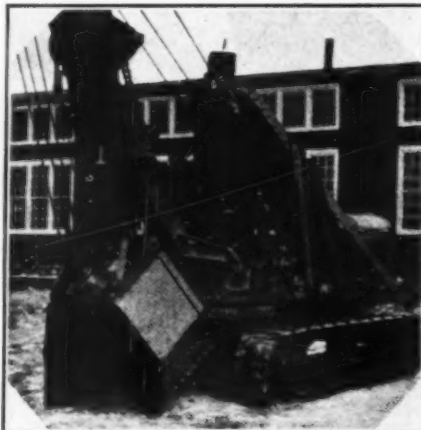
The 5-ft. layer below was removed by hand shoveling.

The average volume moved in a day was close to 3,000 cu. yd. Snow was removed to a width of 15 ft. It is stated that the operating cost of the shovel ran around \$75 a day. About 15 miles of road were opened, and the shovel has proved the most satisfactory means of keeping this section open that has been found.

Bucyrus-Erie shovels, familiar to contractors and engineers everywhere, are built by the Bucyrus-Erie Co., South Milwaukee, Wis.

Bay City Equipment.—A special 1-yd. snow bucket, designed for loading snow, slush or ice in city streets, has been developed by Bay City Shovels, Inc., Bay City, Mich., for use with the Bay City tractor shovel. The bucket is 42 in. wide at the lip and 44 in. wide at the rear. The height is 30 in. and the depth 34 in. The bucket attaches to the standard tractor shovel dipper handle. According to the manufacturers, it can be installed in less than 30 minutes and it can load snow into trucks at a rate of about 3 cu. yd. a minute, depending upon the depth of the snow. This bucket is especially useful for loading piles of snow along the pavement curb line.

Universal Cranes.—Universal cranes, manufactured by the Universal Crane Co., Lorain, Ohio, are used by many municipalities for loading piled snow into trucks, and for clearing unusually heavy drifts. These trucks are quickly transported to the scene of action and for this reason they are often used to form the nucleus of an efficient reserve snow-fighting force. The 1½-yd. bucket is probably most commonly used. The bucket, with its clam-shell action, bites through the frozen snow and ice without a great deal of difficulty. Universal cranes used for snow-removal are available for other uses throughout the rest of the year. In New York City as many



Bay City 1-Yd. Snow Bucket

as thirty of these units have been in use on snow-removal work at one time.

Gifford-Wood Ice Leveler.—The Gifford-Wood street ice leveler is used extensively in numerous northern cities by municipalities and street railway companies for removing the accumulation of ice and frozen snow on city streets and other public highways during the severe winter period. This machine cuts out the humps between the wheel ruts and leaves a level street, slightly corrugated to provide a sure footing for automobile tires. It will cut the ice loose to within 1½ in. of the pavement. This machine is made by the Gifford-Wood Co., Hudson, N. Y.

The ice is shaved off by a cutter bar, provided with alloy-steel cutting teeth. The cutter bar is mounted in a frame provided with runners, a yoke or pole and a driver's seat. The bar will cut to a maximum depth of 6 in. below the level of the runners. The cutter bar is easily raised and lowered, or completely removed for sharpening of the teeth. The cutting teeth are sharpened by grinding the top edge only. They will maintain a sharp cutting point throughout one or two days of normal operation, provided they are not allowed to drag on the pavement, the manufacturers say. Buffer teeth prevent the cutting teeth from coming in contact with the pavement.

The leveler may be pulled behind a standard tractor or any motor truck. A team may be used if motor power is not available. The runners are spaced to fit the wheel ruts. The machine is best operated at a speed of from 3 to 5 miles an hour.

This machine has enjoyed a wide use throughout the New England states, and has won the approval of city officials wherever it has been used.

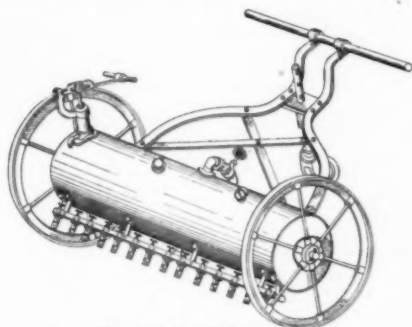


A Universal Crane on the Night Shift in Detroit, Mich.

Bisbee Snow Melter.—The Bisbee snow melter is built on the plan of a push cart. The wheels are attached to the fuel tank, which carries a battery of fifteen blow torches similar to those used by painters and plumbers.

This machine, made by the Bisbee Mfg. Co., Baltimore, Md., was designed for use in the narrow streets of large cities. When the snow starts to fall a man pushes the melter along the street. He is followed by other melters if this is found necessary. The torches melt the snow instantly and the warm water is carried into the sewers.

While this snow melter was originated primarily for use in keeping streets open in big cities, it is equally



The Bisbee Snow Melter

useful for use in railroad yards, on street railway tracks, around institutions and industrial plants and in deep cuts along highways.

Detroit Snow Brush.—The Detroit street sweeper and snow brush, for use with Fordson and McCormick-Deering tractors, is a particularly valuable piece of equipment for municipalities to possess during the winter months. According to the manufacturers, it will



Gifford-Wood Street Ice Leveler in Operation at Glens Falls, N. Y.

handle snow as deep as 10 or 12 in., making a clean sweep and keeping a path clear for the tractor. Being driven from the tractor engine and working ahead in plain view of the operator, it can be maneuvered at will. The construction is simple, and the brush is installed and operated with ease.

The brush, which is placed at an angle of 35 deg., is 6 ft. long and is filled with split bamboo. The brush revolves at a speed of 120 r.p.m. and is driven by a 1,000-r.p.m. engine. The Detroit brush, illustrated on this page, is manufactured by the Whitehead & Kales Co., River Rouge, Mich.

Metalvane Emergency Units.—Metalvane is an all-metal emergency snow fence, manufactured by the Metalvane Snow Control Corp., Sioux Falls, S. D. Metalvane units can be erected before, during or after a storm; what is considered to be adequate protection is erect-

ed in the places where drifting is anticipated, and an emergency supply is kept on hand to fill in the unprotected places where drifts may develop during the storm.

This fence consists of a series of metal vanes, secured to an angle-iron frame. The vanes are made of galvanized steel strips, crimped to form a V-shaped projecting rib. The finished vanes are 4 ft. long and 3 in. in width. They are secured to the frames by lips punched in the top and bottom members of the frame. The frame is made of 1x1½-in. galvanized angles, and is 12



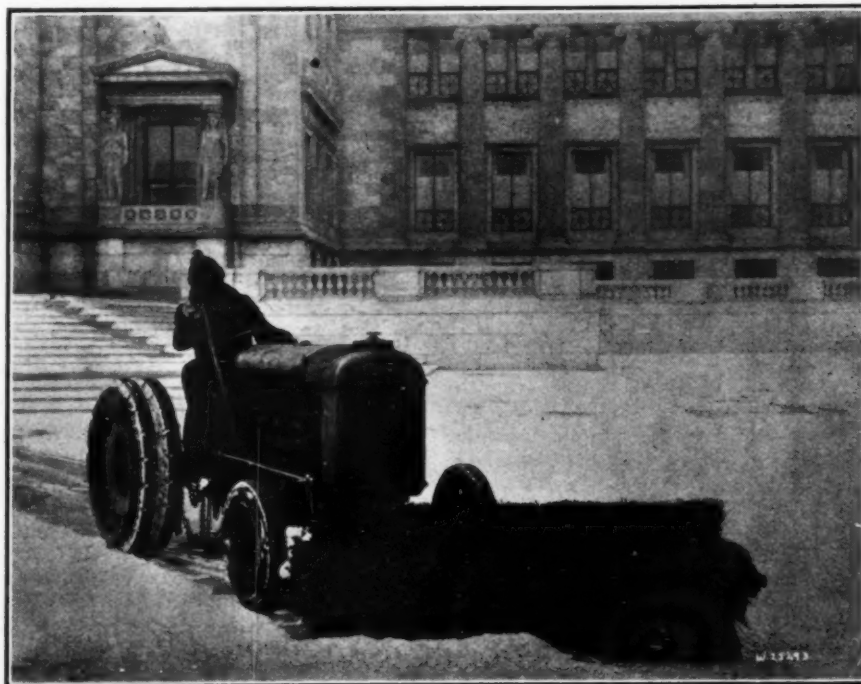
A Unit of Metalvane Emergency Snow Fence

ft. long and 3 ft. 6 in. high. The frame with the vanes attached is held up by angle-iron braces at the ends and the middle, secured to the ground by pins.

The action of the fence is to break up the direct current of the wind into cross-currents, thus causing the wind-borne snow to be deposited in a harmless drift back of the barrier. The vane action makes the units self-cleaning, the manufacturers claim; thus there is no clogging or drifting on or over the fence.

Metalvane is suitable for permanent as well as emergency use. However, a temporary fence is desirable in many places where drifts occur year after year, since it allows land to be released for useful purposes.

Blizzard Buster Snow Fence.—Blizzard Buster fence is manufactured by the Northfield Iron Co., Northfield, Minn. It consists of pressed-steel boards, supported by angles and, in some cases, anchor braces. The galvan-



A Detroit Brush Mounted on a Fordson Tractor, in Use on Chicago Streets

ized boards are 6 in. wide, and the panel length is 8 ft. The posts are painted steel angles, 6 ft. long and driven to give a height of from 4 to 4½ ft. The braces and anchor pins are made of ½-in. round steel. It is stated that the braces and anchors are not needed



An Installation of Blizzard Buster Snow Fence. This Picture Was Taken After a Hard Storm

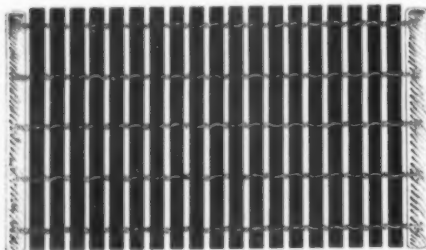
except in loose soil, or where extra-length posts are used. The posts and boards for 3,000 ft. of fence occupy no more space than the box of an ordinary farm wagon, the manufacturers say.

The posts are driven on about a 30-deg. slant, so that the tops lean against the wind and away from the road. The boards have V-shaped vanes, and the vane faces are placed toward the road. The fence is built with about 6 in. of clearance under the bottom rail. The wind is deflected down to the ground just back of the fence, and the snow is collected in a drift before it reaches the roadway.

Satisfactory reports on this fence come from all over the blizzard belt. Officials state that two men can easily erect 3,000 ft. of fence in a day.

Mattson Snow Fence.—Railroads and state highway departments throughout the snow belt have found snow fence an indispensable part of their snow-fighting program. They have found the ideal combination to be prevention of drifting, accomplished by the judicious use of snow fence, along with removal of the snow that falls on the right-of-way by means of plows, loaders or melters.

Mattson combination wood and wire fencing, made by the Mattson Wire & Mfg. Co., Inc., Joliet, Ill., is a success-



A Section of Mattson Combination Wood and Wire Fencing

ful type of snow fence. This fencing is made from heavy pickets cut especially for this purpose, woven between steel wire, heavily galvanized to give maximum protection from rust. The fence is woven on high-speed automatic machines with reversible twists between each picket. This, say the manufactur-

ers, prevents the pickets from being pushed up and down in the cables and keeps the picket tops perfectly even. The fencing is shipped in rolls of convenient length.

Sno-Bar Fence.—Sno-Bar is a portable snow fence, constructed of boards and steel standards. The standards are hinged at the top and spread out at the bottom. They are slotted to receive the boards. The height of the fence may be varied by leaving off the top boards. It is stated that enough material for 450 ft. of fence can be loaded



Sno-Bar, a Portable Wood and Steel Fence

on the running gear of an ordinary dump wagon.

Sno-Bar is manufactured by the Geo. L. Barrus Co., Lithia, Mass.

Traffic Death Rate Continues to Increase

Nineteen of the nation's largest cities will lose from 20 to 40 citizens for every 100,000 population this year from motor vehicle fatalities.

These figures were cited recently in the highway safety campaign of the American Road Builders' Association as indicative of the great need for courtesy and caution on the part of every driver and pedestrian, for all are potential victims of this great evil of modern transportation.

The total of traffic deaths for the first eight months of 1929, which was 8.5 per cent higher than for the same period of 1928, forecasts at least 30,000 deaths and possibly more by the end of the year. The worst months of previous years have been the autumn and early winter months and it is assumed that this year will not be an exception.

Several cities had traffic death increases of 100 per cent or more, comparing the August figures with those of August, 1928. An average of 91 persons were killed each day in August, according to figures of the National

Safety Council, which has reports from about one-half the country showing that more people were killed by motor vehicle accidents in the United States in August than in any previous month in our history.

If the proportionate increase by months follows the trend of former years, December, 1929, will see 3,300 deaths—nearly 110 persons daily.

The proportion of pedestrian deaths, which continues to rise, in August was 56 per cent. The opening of school always has brought a higher total figure of pedestrian deaths, as from 40 to 60 per cent are of children under 15 years of age.

The child driver, so commonly blamed for a large share of motor accidents, had a very small part in the accidents reported in August, as, out of 13,000 drivers involved, all but 150 were 18 years of age, or over.

Pittsburgh, Pa., led the list of larger cities, those over a half-million population, which reported in August. Its death rate was 24.8, or approximately 25 persons killed for each 100,000, if the average monthly deaths continue the same for the final four months of 1929. Cleveland, O., was second with a rate of 22.7. Boston is lowest in this group with a probable rate of 14.

In the list of cities between 300,000 and 500,000 population, Cincinnati's approximated death rate is highest, 24.6, and New Orleans is close behind with 23.8. Rochester, N. Y., with a possible 10.4 death rate, is lowest in this group.

Among the cities between 100,000 and 300,000 population, San Diego, Calif., has an approximated rate of 42, and Dayton, O., is next with 32.6. Wilmington, Del., which went on the August honor roll for completing the month without a motor-vehicle death, has only had three deaths in the first eight months this year and bids fair to end the year with a death rate of 2.4.

The highest rating in the entire list of reporting cities comes in the class under 100,000 population, which is contrary to the general idea that the greatest traffic danger is in the largest cities.

Atlantic City, N. J., with a death rate that may average 46.2 persons of each 100,000 population this year, heads this group. Chicopee, Mass., is second with 19.3. Low honors of this class go to Shreveport, La., which has had only one traffic death this year, none in August and has an average rate of 1.4, giving it the distinction of being the safest city in the country in which to drive or walk about the streets.

The American Road Builders' Association has consistently fought for wider and safer streets and highways, sane traffic legislation and its strict enforcement, elimination of grade crossings, dangerous curves and other hazards, uniformity of traffic control. It is believed that in addition to all these efforts, the driver and pedestrian must contribute courtesy and caution to the great cause of highway safety.